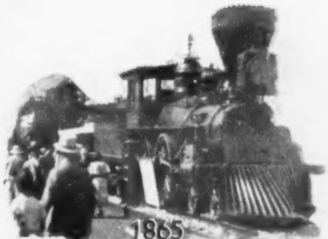
August, 1933

Railway Engineering and Maintenance

A Century of Progress

1829
The Stourbridge Lion
The D. & H. R. R.



1865
The "General"
The N. C. & St. L. Ry.

America's Roadways Make Possible America's Locomotives

1933

Europe's Fastest
The Royal Scot
Weight including tender
382,000 lb.

Typical of America
The Burlington 3000
Weight including tender
717,930 lb.

IN THIS ISSUE
Is the Water Station Obsolescent?

WELD MORE *to* SAVE MORE

BUILDING UP and HEAT TREATING rail ends with AIRCOWELDING, adds years to rail life.

These operations are performed most effectively with AIRCO Oxygen, Acetylene, Apparatus and Supplies.

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NEW YORK, N. Y.

A NATION-WIDE WELDING SUPPLY SERVICE

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No. 56 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Advertising in the "New Deal."

July 27, 1933

Dear Reader:

"The new law will bring to the fore the sales problems of the manufacturer. Good advertising will become more important than ever. There should be greater competition than before in presenting quality products to consumers and in selling those products. Advertising must help business and the government alike to bring about the new order of things as quickly as possible."

In this characteristically positive manner, General Hugh S. Johnson, picturesque administrator of the National Recovery Act, a few days ago replied to the fears of those business men who saw in this newest legislation of the national government, not only the fixing of wages and working conditions, but also price control, production and sales quotas and other measures for the stifling of individual initiative in business. Rather, advertising is to be placed on its most constructive basis - that of educating the potential user to new and better materials and machines. By eliminating the "price cutter" and the "big shipper," sales will be made more than ever before on merit - a development that will be most helpful to manufacturers of quality materials and to those railway men who want such materials but who have all too frequently been thwarted in their efforts to get them.

I believe that those of you who, as manufacturers of quality products, use the pages of Railway Engineering and Maintenance from month to month to bring the merits of your products to the attention of railway officers, will find these pages even more necessary in the future. I believe, also, that those of you who, as railway men, turn to the advertising pages from month to month for information and suggestions regarding materials and equipment that will be helpful to you in the conduct of your engineering and maintenance activities, will find even more help in these pages from now on. In brief, as the "new deal" is developed more fully, the pages of Railway Engineering and Maintenance, which have come to be so widely recognized as the medium of education in engineering and maintenance of way practice, should serve you more completely than ever before.

Yours sincerely,

Elmer T. Howson

Editor

ETH*JC

MEMBER: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

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Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

AUGUST, 1933

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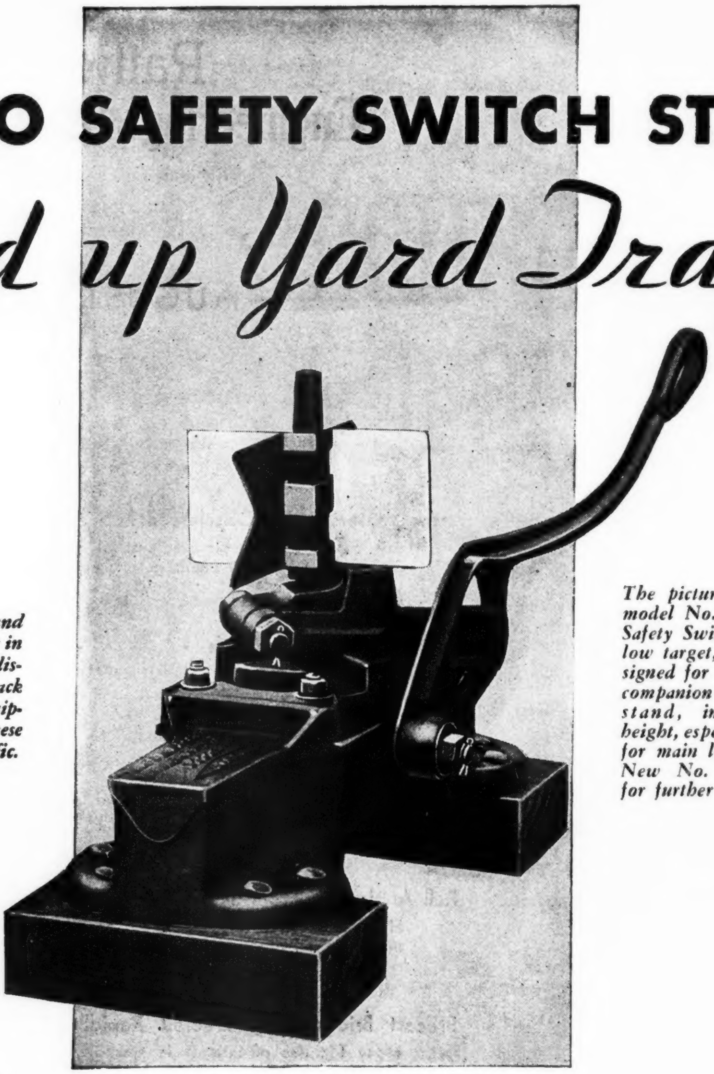
speed up Yard Traffic



Behind Racor Service stand nine plants specializing in the manufacture and distribution of railroad track turnout and crossing equipment, including Manganese Work for heavy traffic.

The picture at left is a model No. 20-B Ramapo Safety Switch Stand with low target, especially designed for yard use. The companion safety switch stand, in intermediate height, especially designed for main line use, is the New No. 17-B. Write for further information.

IN THE rapid handling of cars during switching operations there is the ever-present chance of shunting cars through closed switches with resultant damage to switch points and rigid switch stands. Regardless of the known hazards of such miscalculations, and in spite of the discipline with which switching crews are imbued, mishaps of this kind are frequent. Invariably, with rigid switch stands, they result in delay and expense. This constant threat of trouble makes men over-cautious and slows up their work.

Ramapo Safety Switch Stands completely eliminate all the penalties of trailing through closed switches. When this occurs, a spring mechanism allows the points to move over under pressure of the wheel flanges and properly carry the car on its way. No damage is done to the points or to the switch stand. The target follows the points and indicates their true position, whether thrown automatically or by hand.

So successfully have these simple devices done their appointed task that more than 300,000 of them are in use on 300 railroads.

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Railway Engineering and Maintenance

CODES

A Means of Eliminating Unfair Competition

ALL Washington is now code-minded. It is thinking of little else. A code for the cotton textile industry, a code for the lumber producers, a code for the steel makers, codes for this industry and that, and finally a general code for all industry. Truly we are rapidly becoming code-minded, whether we like it or not.

These codes have as one of their objectives the elimination of the selling of services or products below cost, a practice which has undermined industry of late and driven it to the wall. Under the codes, the price cutter is to be eliminated, for it is expected that sales will be made at prices sufficient to cover all proper costs. The first step in the determination of a fair price is, of course, to ascertain the cost, in all of its details. Producers are then to refrain from selling below this figure.

With this attitude, the railways and their employees should have much sympathy, provided it is carried to its proper and logical conclusion. This is true because no small part of their troubles are due to the competition of other agencies which are selling transportation below the cost of production, a condition that is made possible only by the "doles" handed out by the public in one form or another.

The Waterways

Take the waterways. On the Erie canal, on which the state of New York spent $346,000,000 for construction and maintenance up to 1929, barges are operated toll-free, the state paying all interest charges and also all expenses for lock operation, etc. As a result, the barge operator pays only the cost of operating his tows, right of way and roadway (the waterway) being provided for him free of expense. To do this costs the state of New York more than $14,000,000 annually, an amount sufficient to pay to the railways the full tariff charges for all of the traffic carried on the canal and leave a surplus for other purposes. This is the contribution (amounting to approximately $5 per ton of freight handled on the canal) which the public of this state makes to canal operation. It is a very real part of the cost of canal transportation which is not now included in the selling price.

A similar condition exists on the Mississippi river where the federal government not only provides the channel, but also maintains it so that privately-owned barge lines can operate on it at will without toll or rental of any sort. For this service, the federal government spends approximately $15,000,000 of public money annually. As a result, the shipper pays only about 40 per cent of the actual cost of this service, while the remaining 60 per cent is made up from the public treasury. And so it goes with the Ohio and Missouri rivers and elsewhere on our improved inland waterways.

Air and Highways

Air mail presents another phase of the same general problem. Here the government provides airway beacons, landing fields and other aids essential to air navigation at a cost of from $3,000,000 to $9,000,000 annually. Furthermore, the post office department pays as direct subsidies to the air lines more than $10,000,000 a year, in addition to bonuses for passengers carried in mail planes. It is because of these expenditures, aggregating more than $15,000,000 annually, that the aviation companies are able to offer passenger transportation at other than prohibitory rates. The public again pays the difference between the passenger fare and the cost of this transportation service.

Still another and far more serious form of subsidized or partial-cost competition is that provided on the highways. Here a vast commercial transportation industry is being developed on roadways built and maintained with public funds, where the only return is in the form of limited registration fees and gasoline taxes, which income, for all vehicles, pleasure as well as commercial, in the active years of 1921-30, inclusive, totaled only 36.3 per cent of the expenditures made by state and local authorities in those years. Here again the public paid the balance of the cost of transportation, an amount exceeding seven billion dollars.

Thus, in all of these various channels, competitors of the railways are failing to include in their charges to patrons, all of the elements of cost that enter into their service, and by ignoring those paid by the public, are enabled to "cut" the rates which the railways, deprived of the benefit of such subsidies, are required to charge. These are clear-cut examples of price cutting within the transportation industry of the form that the government, through the codes that are being drawn under the Industrial Recovery act, is endeavoring to eliminate. Surely if this practice is sufficiently destructive in other industries to demand corrective action by the government, it is equally so here, especially when this price cutting is made possible through the direct action of the government itself. The present plight of the railways is ample evidence of the fact that the effects of this destructive

competition are just as real in transportation as elsewhere.

But, it may be pointed out, the government has also provided money for the railways. So it has—but on vastly different conditions. Here the money is advanced in the form of loans and then only when security is posted satisfactory to both the Interstate Commerce Commission and the loaning body. Furthermore, these loans bear interest at the rates of 5½ and 6 per cent. They carry none of the earmarks, therefore, of gifts, doles or subsidies. Under these strict conditions, the Reconstruction Finance Corporation loaned the roads a total of $372,778,401 up to June 26.

Will They Be Repaid?

Will these loans be repaid? The best answer is that this is already being done, $20,544,050 having been repaid up to June 26 and additional amounts since. For further evidence, one may turn to the record of the years during and immediately following the period of federal control. In this period, the United States loaned the roads almost $1,116,000,000. Of this amount the railways have since repaid all but $33,600,000. In addition, they have paid interest at the rate of 6 per cent to a total of more than $180,000,000. The government, on the other hand, secured this money at a cost of about 4 per cent, so that it made a profit of some $60,000,000, or $26,000,000 more than the total amount of the loans still outstanding, part of which will still be repaid. There is nothing, therefore, in the nature of a subsidy in the aid given the railways.

In the light of the emphasis which the government is now placing on the elimination of unfair competition within industries, it is not amiss for railway employees to direct attention to the inconsistency of its treatment of the railways and to emphasize the destructive effects of this inconsistency. If the government is to insist on fair treatment between competitors in business, it would appear that, in all fairness, it should itself adopt the same practice in its action towards different units within the transportation industry.

ORGANIZATION

The Same Plan Will Not Fit in All Cases

THE outstanding characteristic of the current movement for the reorganization of track forces is the diversity of the plans being adopted or subjected to trial. It is not surprising that this is so because track maintenance is now in a period of transition, during which every conceivable suggestion is being considered and various plans that offer promise of a practical solution are being tried. But it should also be obvious that a plan of organization that is satisfactory under one set of conditions may not be the best answer where the conditions are different; in fact, one railway that has instituted a drastic change in the administration of its gangs has decided not to apply this plan to certain stretches of its lines where the work required of its gangs is of a character that warrants a different distribution of the forces. It is well known, also, that the forms of organization now being adopted on the branch lines of certain railways are not suited to most main lines.

The very fact that track maintenance is not being conducted under the same form of organization on all railways or on all parts of the same property is in itself evidence of the study that is being given to all phases of the subject. Until about five years ago the gang organizations of all railways were cut to substantially the same pattern, section gangs differing only as to the number of men and assigned mileage. It is only recently that track maintenance officers have had the courage to question whether the form of organization which had long been assumed to be the best might be improved.

MODERNIZATION

Water Service Affords an Outstanding Example

RAILROADS enjoy about as much privacy as a gold fish. Every man, whether he be a college professor or a drygoods merchant, is seemingly qualified to pass judgment on the policies and methods of railway managements, and in the majority of cases expressions of opinion, either verbal or written, disclose a conviction that almost any layman could do things better. What are the facts?

To attempt a survey of the efficiency of an industry possessing as many ramifications as railway transportation would be an exceedingly formidable task, but the review of the policies and projects of the railways with respect to a single item of operation, namely, water service, which is presented on page 362 of this issue, may be offered as a partial answer. As a matter of fact, the attitude of railway managements regarding water service is especially pertinent because it is so closely interrelated with practices and economies in train operation and because the policies pursued with respect to the projects for modernization as a means of lowering costs of plant operation should serve as a measure of the attitude of the railways toward other phases of their business.

As the article shows, the answer is conclusive, for the railways have been in the process of rebuilding and improving their water supply facilities for years, especially during the last twenty. What is more to the point is that such construction work has been predicated to only a minor extent on the demands for more water. True, they have built plants of larger capacity, capable of delivering a greater quantity of water to locomotive tenders in a given time, but, as the article points out, the need for these larger plants has grown out of a desire to improve train operation—specifically, to reduce the number of stops for water by using larger locomotive tenders. The same objective is seen in the large programs for improving the quality of water, the most recent influence in this direction arising out of the widespread movement for longer locomotive runs.

Turning now to projects having their origin within the water service department itself, we find that the prime incentive is to be found in the reduction in the cost of power, attendance and maintenance incident to the operation of the water stations. The remarkable ad-

vances made by the railways in this direction have been possible only because of the improvements made by manufacturers in pumps, power units, and control equipment; nevertheless they would not have been realized if railway water service officers had not been alert to apply them. The extent of the improvements made along this line is clearly brought out in the article.

Obviously the magnitude of modernizing programs carried out on different roads has been subject to wide variations. Some railways have rebuilt practically all of their main-line facilities, others only a few. But this is due to differences in capacity, to finance or differences in requirements or local conditions. What is brought out clearly is that all have done something, indicating a universal appreciation of the economic possibilities; the work will go on as soon as opportunity permits. If the railways are guilty of a lack of foresight and enterprise it is necessary to look for it elsewhere than in the water supply department, for the very fact that the improvements already completed have shown attractive returns on the investment is providing the needed support for the initiation of still other projects.

BETTER TIMES

All Indications Point to Improved Business

BUSINESS is continuing to get better. According to William Green, president of the American Federation of Labor, 1,500,000 unemployed persons have returned to work between March and June. Factory employment reached 64.8 per cent of the 1923-25 average in June, compared with 60.6 per cent in May. The cotton and woolen mills and shoe factories report marked gains in production. Retail sales in all lines show pronounced advances. Many other indices could be cited, but in no field is the evidence of improved business more pronounced than in railway transportation.

Carloadings for the last week for which figures are available, namely, June 15, totaled 648,206, or only slightly less than for the peak figure for 1932, while carloading figures now available for individual roads indicate that the total for the week ending June 22 will exceed the total for any week since the autumn of 1931. The showing with respect to earnings is still more remarkable. Thus, for the four months ending with April, the net railway operating revenues (Class I roads) totaled $52,761,418, an average of less than $13,200,000 per month. But with net railway operating revenues for May of $40,693,073, and an estimated total of not less than $60,000,000 for June, the Class I railways will show net operating revenues for the first half of this year of about $153,000,000, or about $41,000,000 more than in the first half of 1932. And it is certain that, when the figures for July are compiled, they will show an even greater improvement.

Without attempting to explain the underlying reasons for the improvement in business conditions, it should be clear to everyone that the immediate cause is increased buying. This is surely the case with the railroads; they are handling more traffic only because more carloads of various commodities are being bought. But in spite of the fact that the railways are one of the chief beneficiaries of better business, they themselves have as yet contributed very little to the buying movement, and no department of the railways has done less to improve business than maintenance of way.

Officers of the department have seen their budget recommendations cut time and again. More recently they are told that R. F. C. loans must be paid off and that deficits in the requirements for fixed charges must be made up before appropriations for maintenance can be increased and, moreover, that the properties are standing up well under the prevailing low level of expenditures for upkeep. However, it is the maintenance officer, and not someone else, who is responsible for the safety of traffic and the protection of the property against irreparable deterioration. No one knows as well as he how great the needs are. Consequently, it is he who must initiate movements for greater maintenance activity and, therefore, greater expenditures for labor and materials, which in this case will surely help the railroads as much or more than they will help business as a whole. He must get over the depression complex before it is too late to get anything done this season.

REPAIR

There Is Always an Economic Limit

ONE of the outstanding consequences of the period of depressed railway earnings has been the ingenuity that maintenance officers have evinced in devising ways for avoiding the purchase of new materials. Force of circumstances has compelled them to seize upon all possible means of repairing defective elements of the track structure. Much has been done which in normal periods would have been deemed impossible, and there is no question that progress in the application of such processes as the welding of broken and worn manganese trackwork has advanced further in the last three years than they would in ten years of normal business activity. The result is an entirely new conception of the service life that can be obtained from such construction.

However, as in all periods of curtailed expenditures, repairs are too often carried beyond the limits of true economy. The decision to undertake further repair work is founded too often on a comparison of the out-of-pocket expense involved with the cost of a complete renewal, rather than on a study of the real economies involved, namely, the cost in terms of added service life. As a consequence, there are now many frogs and crossings in track on which the cost of repairs per month of service is more than the corresponding interest and depreciation on new units.

Most maintenance officers are well aware that this is true, but they also know that one can be too poor to practice true economy. On the other hand they can be prepared to voice their views and back them up with the facts as the current improvement in business conditions gives rise to more nearly adequate maintenance appropriations. Statements of the cost of keeping worn materials and appliances in track, compared with the fixed charges for new ones, will readily prove the case.

Is the Water Station Obsolescent?

Are the railways keeping abreast of developments in equipment and processes, or are they allowing their plants to get out of date?

ARE the railways obsolescence conscious? To be more specific, are they alert to the newer developments in water service equipment and processes? Or are they so deeply submerged in the details of handling transportation that they are not aware that *every* unit of the railway plant, whether it be a part of the fixed property or a locomotive or a car, must be kept abreast of the times if the railway as a whole is to render the most efficient and economical service?

To determine what influence obsolescence exerts on the minds of railway officers with particular reference to water facilities and how much emphasis is being placed on the modernization of these facilities, a survey has been made of the practices of 27 representative railways which reach every section of the United States and Canada, and which comprise 130,000 miles of lines, or more than half of the important lines of the two countries. The officers of these roads were requested to discuss freely the extent to which their water-service facilities have been rebuilt in recent years and the reasons therefor. This included the rebuilding of stations in whole or in part; the enlargement, alteration or relocation of existing plants; and the construction of additional facilities. Inquiry was made also to determine the influence of larger locomotive tenders on the rebuilding or relocation of water stations; and how the various influences which have affected the character and volume of the water supply have reacted on service and the costs of operation and maintenance.

Locomotive Developments Affect Demand for Water

Even a casual consideration of these questions makes it obvious that the marked developments in locomotive design and use which have been in progress in recent years could not do otherwise than exert a profound influence on the demand for boiler waters. Larger locomotive tenders have permitted a greater interval between stops for water, but they also make a heavier draft on the supply at points where water is taken. Larger boilers, higher steam pressures and the ability of the locomotive to pull heavier trains at higher speeds have brought about a demand for water of better quality, which demand has become more and more insistent during the last decade. During this period also, locomotive runs in both freight and passenger service have been extended until many of them now include three or more former engine districts. This latter development, in addition to creating a similar demand for better water, has emphasized even more strongly a crying need for water of uniform quality.

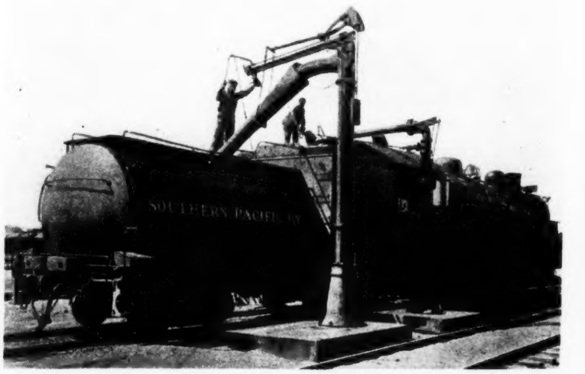
Added to the physical demands that have been made on the water-service facilities, there has been an equally insistent demand for greater efficiency and economy in their operation. It is obvious that these various forms of pressure should have provided an incentive for the installation of equipment and of processes which will meet the requirements that have thus been raised.

How have the water service departments of the various railways met their responsibilities in these respects? This is a pertinent question which cannot be answered in general terms, but must be treated specifically for each class of equipment which goes to make up the water service plant as a whole, as well as for each of the major conditions which have been and still are exerting their influence on water service activities. In seeking these answers it should be kept in mind, however, that a water station is seldom either rebuilt or improved for a single season. In discussing the information obtained in making the survey no attempt will be made, therefore, to allocate any of these improvements to a single reason, but only to show what influences have prompted them.

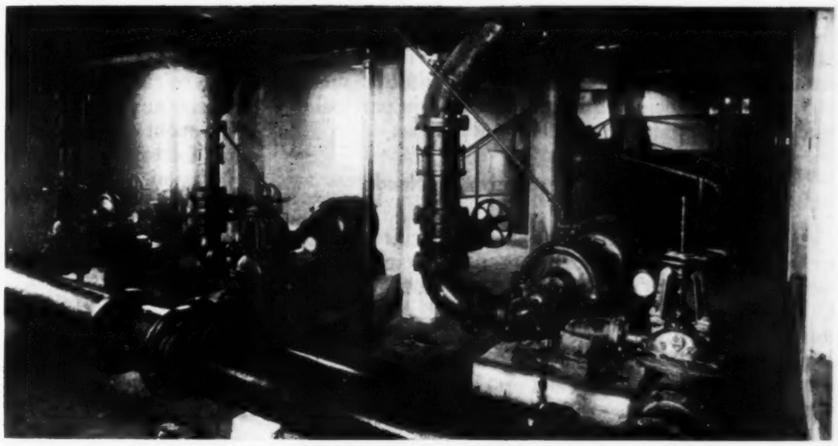
Reasons for Modernizing Water Stations

The information obtained from the various railways shows that it has been necessary to rebuild many plants, enlarging them and installing more modern equipment to bring them to the needed capacity or to insure complete mechanical dependability. In not a few instances the original supply of water was insufficient to meet the new demands or did not provide enough reserve to insure dependability of the supply during traffic peaks or seasons of subnormal rainfall. In these cases it became necessary to relocate certain water stations or secure additional supplies, as well as to rebuild or enlarge the pumping and power units, to prevent actual or potential water shortages. In other cases relocations were made to secure water of better quality, while in still others they were made primarily to conform to the spacing that was best suited to serve the larger locomotive tenders; in many instances the need for more economical operation was the primary or a secondary reason.

Coincident with these improvements, usually in connection with them but often entirely independent, larger or more modern service storage was required, as

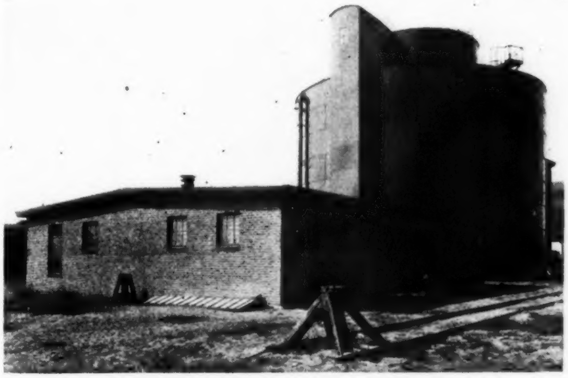


The Renewal of Water Columns With New Ones of Greater Delivery Capacity Reduces Train Detentions



Electric Motor-Driven Centrifugal Pump Installations Occupy Little Space and Are Adapted to Automatic or Remote Control.

Below—The New York Central's Water Treating Plant at Elkhart, Ind., the Largest in the Country, Has a Capacity of 150,000 Gal. per Hr.



well as better distribution and quicker delivery of the water. This called for additional or larger service tanks, additional or larger pipe lines, and water columns. Likewise, although it is the practice when relocating water stations to secure the best water available, most of the officers who assisted in making the survey called attention to the fact that in many cases the best water available is not satisfactory for boiler use. As a result, it has been necessary in some cases and highly desirable in others to soften the water, thus requiring the construction and operation of treating facilities, or in some instances the reconstruction or enlargement of such facilities.

As an indication of the magnitude of these activities, to mention only a few roads, the Great Northern has constructed 70 plants and rebuilt 310 since 1913; the Seaboard Air Line has constructed 8 and rebuilt 40 plants in the last 5 years; the Texas & Pacific has rebuilt 82 stations since 1918; the Southern Pacific Lines in Texas and Louisiana has built 20 new stations and rebuilt 90, out of a total of 264, since 1921; the Chesapeake & Ohio has built 20 new stations and rebuilt 102 since 1923; the Baltimore & Ohio has built 6 new plants and rebuilt 125 in recent years; and the Illinois Central has rebuilt or relocated 360 plants since 1913.

Since the primary purpose of railway water service is to insure a dependable supply of satisfactory water for delivery to locomotives, water stations are quite sensitive to changes in locomotive design and methods of operation. The locomotive tender is a case in point. For some years there has been a gradual increase in the size of tenders, until at present capacities of 20,000 gal. or more are not unusual. This growth, although gradual, has had so profound an influence that "on the Northern Pacific," said E. M. Grime, engineer of water service of that road, "we have rebuilt or relocated water stations for this purpose covering a district of about 600 miles of main line." Likewise, "out of 103 water stations on the Wabash," according to E. L. Crugar, chief engineer, "24 have been rebuilt to serve more efficiently the larger locomotives."

As a further illustration of this influence, as well as of the fact that water-service officers are alert to the trends in operation, W. M. Barr, assistant to the executive vice-president of the Union Pacific, made this comment: "For some years we have been following the trend toward the general use of larger locomotive tenders, so that all of our work in the development of water stations since 1920 has been with this end in view. We have built our water softeners with a large margin of capacity and have installed pumping equipment to correspond, thus anticipating the large tenders and longer engine runs."

Has There Been a Demand for Better Water?

Has there really been a demand for better water? If so, what effect has this had on the questions of obsolescence and modernization of the water facilities? What have the railways done about it? Prior to 30 years ago, in developing a source of supply little attention was paid to quality, except to avoid those waters that were known to be particularly bad. As locomotives have increased in size, however, there has been a constant increase in the severity of the service that they are compelled to perform. This has resulted in greater strains on the boilers, which now have a higher rate of evaporation than ever before, and this has been followed by a high degree of sensitivity to the quality of the water that is supplied to them.

It was clearly evident from the discussions that water-service and other engineers in maintenance-of-way work are keenly alert to the importance of providing the best quality of water obtainable. They are aware that otherwise boiler maintenance may be so costly as to more than offset all of the economies or other advantages that can be secured up to the point of delivery, while effect on train operation may be even more expensive.

Replies from these men showed that, wherever practicable, the quality of the water is given preference in selecting new supplies. Where this has not been practicable or the best water obtainable is not satisfactory,

the program for improving the service has usually included also facilities for softening the water. In many cases, where it has not been deemed advisable to construct facilities for pretreatment, the interior method of treatment is being followed, and this is particularly true where the natural waters are corrosive.

Water Service Is Responsive to Needs

As evidence that the water service facilities are responsive to the developments that are being made in locomotives, it has been only a few years since 10 to 12 grains of scale-forming solids to the gallon was considered the limit below which treatment could not be justified. However, as the economic value of treatment has become better understood and as the demand for conservation of boilers has required, the processes of treatment have been refined until it is now a common practice to treat waters containing as low as 3 or 4 grains. In fact, many of the roads reported that they are now softening their boiler waters to 1 grain of residual hardness without overtreatment, while one road said that it is getting a residual hardness of less than 1 grain.

In the beginning only the worst waters were treated, and as each plant was considered an individual problem it was designed accordingly. However, as locomotive development progressed, the value of water of uniform as well as superior quality has been recognized and the next step has been to install softening plants over entire engine districts. Then, as long engine runs have become more common and more engine districts have been included in a single run, it has been found in many cases that waters which were satisfactory for locomotives operating on a single district are less satisfactory when they were operated over several districts. This has led to further refinements in the processes of treatment, to obtain a practically uniform product at all water stations over these extended runs.

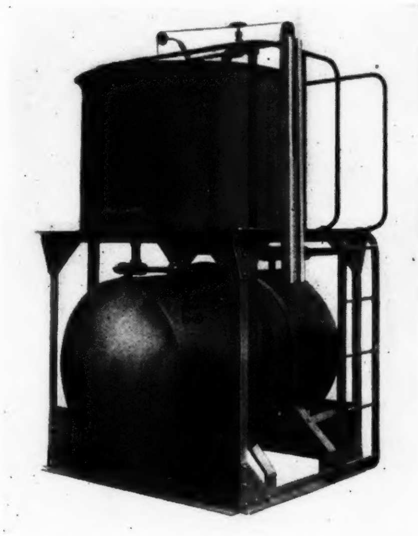
As the necessity for these further refinements has arisen, existing plans which were still in excellent physical condition have become obsolescent and have been completely overhauled or replaced, or new plants constructed. As an example of the weight given to uniformity and of the fact that obsolescence is regarded as important, one road has recently rebuilt or replaced the treating plants on a thousand miles of main-line to obtain uniformity in the water for locomotives assigned to long runs.

Among those who commented on this subject was Earl Stimson, chief engineer maintenance of the Baltimore & Ohio, who said, "the demand for better water has made it necessary to conduct our programs so as to take care of entire engine districts at one time. We have thus obtained water of uniform quality over a district or division, and have now reached the point where our water is substantially uniform on all main-line territory."

Another typical statement was made by R. W. Barnes, chief engineer of the Southern Pacific Lines in Texas and Louisiana, that "in 1921 we had no treatment of consequence, although our water was harder than the average. Since then we have constructed 52 treating plants, with sedimentation where necessary. We now produce water having a residual hardness of less than one grain at all of these plants." "On the Alton," said Armstrong Chinn, chief engineer, "about 1924 we installed 59 water-treating units, which includes all but one of our stations, this exception being where the natural water is satisfactory."

In a water station, where does obsolescence begin with respect to economy of operation? Is this regarded by railway officers as sufficient reason for modernization? From the foregoing it is clear that a large amount of construction, reconstruction and replacement of facilities has resulted from the obsolescence created by changes in locomotives and in their operation. The demand for greater economy has also been emphasized, however, and this raises the question as to the influence it has had in creating obsolescence of equipment and the extent to which this form of obsolescence is recognized in preparing water-service improvement programs.

As evidence that this phase of the subject has not been ignored, it was stated by all but a few of the officers to whom inquiry was addressed, that economy of operation was the dominating factor for much of the construction and reconstruction which they have undertaken, and that it was an important collateral reason for practically all of the remainder. Likewise,



Small Plants Such As This Have Greatly Increased the Accuracy of Roadside Treatment

nearly every one of them also discussed the question of economy in connection with the selection of equipment necessary to carry out their modernization programs. A summary of these discussions indicates that in selecting equipment for these improvements, economy of operation—including fixed charges, depreciation, cost of attendance and of fuel or power current—is given the greatest weight, but that reliability is considered to be of equal importance. Considerable weight was also given by a number of officers to the amount of maintenance required. Others said that while this matter should not be ignored, it can be generally accepted that equipment possessing the required degree of reliability is quite certain to have low maintenance requirements. In general, an effort is made to keep first cost as low as is compatible with the foregoing requirements, but most roads consider this to be a minor matter compared with reliability and economy of operation, particularly since the fixed charges and depreciation care for this item.

To what extent has older equipment been replaced with more modern units? What are the trends with respect to the types that are being installed? For many years steam was the only form of power avail-

able for pumping. Later, the gasoline engine came into use, only to be followed by the oil engine, while the most recent type of power unit for this purpose is the electric motor. While a few roads have replaced all or practically all of their steam plants with oil engines or electric motors, others equally progressive have not done so to the same extent, and steam plants still predominate for the country as a whole. Many of these steam plants are being retained where steam can be obtained cheaply from power plants or high-pressure heating plants or where attendance is required for other reasons than pumping.

Trend Toward Electric Power

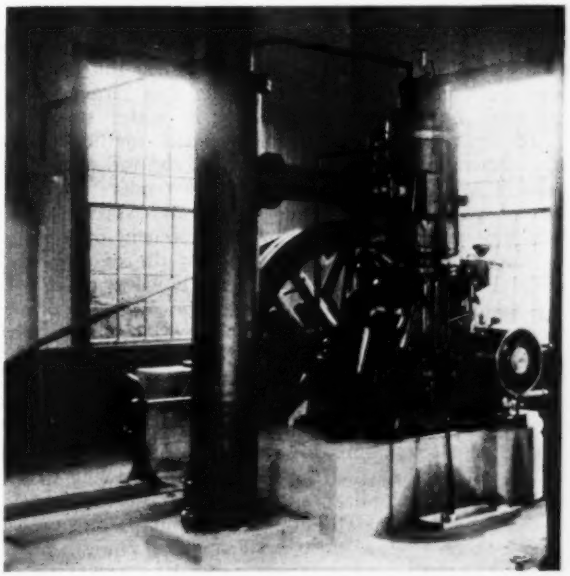
According to the information obtained in making the survey, however, there is a marked trend toward electric pumping, since with this form of power the pumps can be placed under automatic control, thus dispensing with the necessity for constant attendance, as is necessary with steam plants. Attention was called to the fact, however, that in many instances installations of motor-driven pumps have not been made because the energy is not available or can be secured only through expensive construction to reach a power line. In other cases it has been necessary to forego similar installations because the rates for electric current are so high as to make this form of pumping economically impracticable. In still other cases, the electric service has a record of interruptions that make it unsafe to depend on the power. However, speaking for a large number of officers, J. E. Armstrong, assistant chief engineer of the Canadian Pacific, said that "steam plants are being eliminated for economic reasons and replaced with motor-driven centrifugal pumps where reliable power is available at reasonable rates."

In discussing the situation on the Eastern Lines of the Atchison, Topeka & Santa Fe, H. W. Wagner, chief engineer, observed that "out of 142 active water stations, 17 are electrically operated, 16 of which have been converted to this type during the last 10 years. With respect to water production, 8 of these plants are strictly automatic and 5 are under remote push-button control, while 3 are manually controlled by push buttons at the pump. The only attendance necessary at any of these plants is for mixing the chemicals used in treating the water." "On the Seaboard Air Line," stated W. D. Faucette, chief engineer, "40 pumping stations have been rebuilt in the last five years to replace steam plants and internal combustion engines with automatically-operated electric pumping units."

Similarly, on the Baltimore & Ohio, Mr. Stimson said that "we have modernized our pumping equipment entirely along the line of electrification, 61 stations being now equipped with motor-driven pumps, replacing steam or gasoline power or, in a few cases, they have been installed where water was previously purchased. We have also made two similar installations as auxiliaries to other means of supply." Although, by comparison on a mileage basis, the Bessemer & Lake Erie is far smaller, F. R. Layng, chief engineer, indicated the same trend in his statement that "out of nine pumping stations, we have recently replaced internal-combustion and steam units with electrically driven centrifugal pumps at two of these stations."

Although there has been a marked trend toward automatic electric pumping, since the unit cost of the water at the point of delivery can be reduced by eliminating attendance, this does not mean that the railways are discarding the oil engine as a prime mover. As has been shown, there are many stations where electric power is not available, and probably will not be for some years to come. In the meantime, if past experience is any criterion, hundreds of these stations will be rebuilt and the existing pumps and power equipment will be replaced with other units of still more modern design and greater efficiency. That the oil engine demonstrates economy is indicated by Mr. Armstrong's comment that, "when used to replace steam or gasoline, the oil engine operates at about one-third of the former expense, exclusive of attendance."

In this connection, C. R. Knowles, superintendent of water service of the Illinois Central, made a typical observation that "since 1913 we have rebuilt 360 water stations. During this period we replaced older units



Modern Diesel and Semi-Diesel Engines Are Supplanting Steam and Gasoline-Driven Units

with oil engines (including a few gasoline installations at small plants) and centrifugal pumps at 55 points, as compared with 129 steam plants and 30 automatic electric installations." A similar report came from E. A. Whitman, chief engineer of the Minneapolis, St. Paul & Sault Ste. Marie, that "in modernizing our own water facilities, during the last eight years we have replaced internal combustion engines with electric motors at 20 stations; 16 steam plants have been converted to take their power from internal combustion engines; and 12 piston pumps have been replaced with centrifugal pumps." Another typical example is found on the St. Louis-San Francisco, which, according to Col. F. G Jonah, chief engineer, "has been doing away with steam pumps and is replacing them with pumps directly connected to semi-Diesel engines." Although not stating the type of power used, H. W. Van Hovenberg, sanitary engineer of the St. Louis Southwestern, said that out of 41 stations rebuilt on that road in the last 10 years, new power units had been installed at 25.

Storage, Distribution and Delivery

Have other types of water equipment been given equal consideration, or have the efforts at modernization been confined to power units, pumps and water softening? This is an essential question since service storage and delivery systems can suffer as severely from the blight

of obsolescence as the forms of equipment that have already been discussed. Furthermore, if only the latter are kept up to date and to a high stage of efficiency, the development will be decidedly out of balance and the full benefits that should be derived from the expenditures cannot be realized.

Pertinent comment on this matter was made by W. H. Kirkbride, chief engineer of the Pacific Lines of the Southern Pacific, to the effect that "bigger tenders draw more heavily on roadway tanks. As a consequence our older tanks of 17,000 and 20,000 gal. have gradually been replaced with larger ones until today we are erecting tanks of 65,000, 200,000 and even as much as 350,000-gal. capacity."

Another typical illustration was furnished by W. J. Backes, chief engineer of the Boston & Maine, who reported that that road "has replaced 12 50,000-gal. wooden tanks with steel tanks, of which 11 hold 100,000 gal. and one 50,000 gal. At the same time, in connection with our modernization work, the delivery and distribution systems, including five larger water columns, have been increased at 16 water stations."

To what extent have existing water facilities been abandoned, and what is the policy of the railways with respect to this? Larger locomotive tenders have required considerable respacing of water stations, and this has naturally led to the abandonment of a large number of existing plants. Most of the officers who assisted in making the survey said, however, that this did not create a net reduction in the water facilities, since practically all of these plants were rebuilt at new locations. On the other hand, several roads reported a smaller number of water stations than formerly. In most of these cases, however, this has resulted from the closing of small and infrequently used stations that had been maintained for emergency purposes during the era of small tenders. In fact, owing to the construction of additional water stations and the general practice of installing duplicate pumps and power units, there is far more water-service equipment in use today than there was as late as 10 years ago.

Is Modernization Worth While?

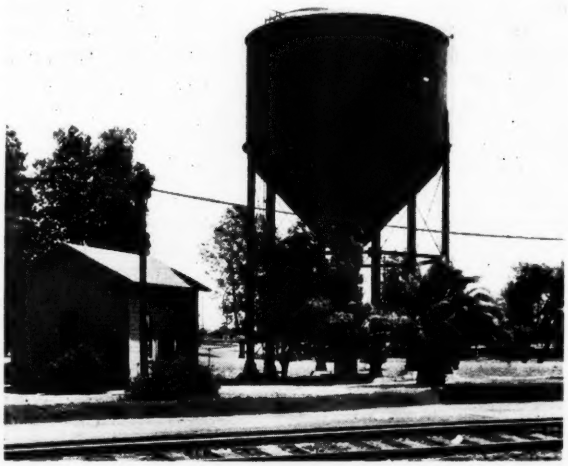
Is modernization worth while? Are the results favorable? In other words, from an economic viewpoint, do the returns warrant the expenditures necessary to keep water stations up to date? Convincing testimony on these points was offered by many officers, among them R. C. Bardwell, superintendent of water supply of the Chesapeake & Ohio, who said that "of 187 water stations, 20 were built new; pumping equipment was replaced at 68, and power units at 47; a total of 66 steel tanks were erected; and the distribution and delivery systems were remodeled or replaced at 61 stations, all since 1923. These improvements, combined with closer supervision, have effected a reduction of 49.4 per cent in the cost of maintenance, despite an increase of 0.4 per cent in gross ton miles. During this period we increased the number of treating plants from 14 to 74, yet in the face of an 83 per cent rise in the price of chemicals our operating costs have declined 33.3 per cent."

Information received from A. N. Reece, chief engineer of the Kansas City Southern, was to the effect that "since 1928 we have modernized 13 water stations. Oil engines were installed at two points, while 11 plants are equipped with automatic electric-driven pumps. Comparing the motorized plants for 1932 with steam operation which prevailed prior to 1929, the water production decreased 25 per cent. Yet the unit cost per thousand gallons was reduced by 5.38 cents, representing a saving of 57 per cent."

"Unit costs for water delivered have decreased since 1921 on the Southern Pacific," observed Mr. Barnes, "despite the fact that we had no water treatment of consequence in that year, while we were treating 70 per cent of the water used in 1931, and the further fact that there has been a noticeable upward trend in the cost of the very large volume of water we purchase."

Another road that has found modernization worth while is the Texas & Pacific, according to E. F. Mitchell, chief engineer, who stated that "service has been helped, particularly through securing more dependable water supplies at proper locations with better spacing. By reason of the modernization of our plants, the cost of our water has declined from 18 cents a thousand gallons to 7 cents."

That modernization pays was made clear also by Mr. Stimson in his statement that "the greatest benefit to the Baltimore & Ohio has been the improved quality of the water, yet we have realized attractive economies with respect to power and pumping equipment. Reduced to dollars and cents, our electric pumping installations are saving $150,000 a year, while the savings resulting from our water treatment have averaged about $1,250,000 a year."



Better Storage Facilities Occupy an Important Place in Modernizing Programs

While not giving figures, J. S. McBride, chief engineer of the Chicago & Eastern Illinois, said that "the cost of water production at our modernized plants has shown a marked reduction, and there has also been a large reduction in the maintenance of both equipment and buildings." A reduction "from 10 cents to 3½ cents per thousand gallons in the cost of the water pumped at one rehabilitated station" on the Delaware & Hudson, was recorded by H. S. Clarke, engineer maintenance of way of that road, who added that "the cost at other similarly electrified stations has also been considerably reduced." Automatic electric pumping on the Delaware, Lackawanna & Western has, according to G. J. Ray, chief engineer of that road, "eliminated pumpers' wages and the expensive maintenance of steam pumps and boilers, thus materially reducing the overall cost of pumping water."

"Service has improved, operating costs have been reduced 24 per cent and maintenance lowered 60 per

(Continued on page 375)

Taking Track Up By Panels

WITH the abandonment of branch lines on the increase, many railroads are endeavoring to devise ways of taking up these lines and salvaging the track materials in an economical and efficient manner. One of the most novel methods was employed recently by the Southern Pacific, Texas and Louisiana lines, which hit upon the idea of taking up track in panels and dismantling it at a central point.

The method in question was employed in taking up about 15 miles of branch line between Luling, Tex., and Gonzales, which was laid with 50-lb. rail having square joints. Using a locomotive crane and a special balancing device the track was picked up a panel at a time and loaded on a flat car coupled to the crane. About 30 panels of track were loaded crosswise on the flat car in three piles and hauled to a dismantling location where the material was segregated, classified and loaded.

The ties and rail were loaded by a Burro crane operating on a side track parallel with the main line. Where existing sidings were suitably located these were used for dismantling locations, but where no side track was available a track was constructed by laying down and connecting up several panels of the track that had been picked up. No turnout was provided, the small crane being set down on this track by the locomotive crane. All spike holes in the ties were plugged and the ties were classified, according to their condition, into three groups. This practice permitted a complete classification of the material at the dismantling point and eliminated considerable work that otherwise would have been necessary at the reclamation plant.

A balancing device, used in connection with the crane for lifting the panels, consisted of a rectangular frame constructed of old rails, from each corner of which a pair of rail tongs was suspended from a large ring supported from the frame by means of a hook. The frame itself was lifted and balanced by four chains fastened to metal loops in the frame, and running to a central ring which served as the lifting bale for the entire assembly.

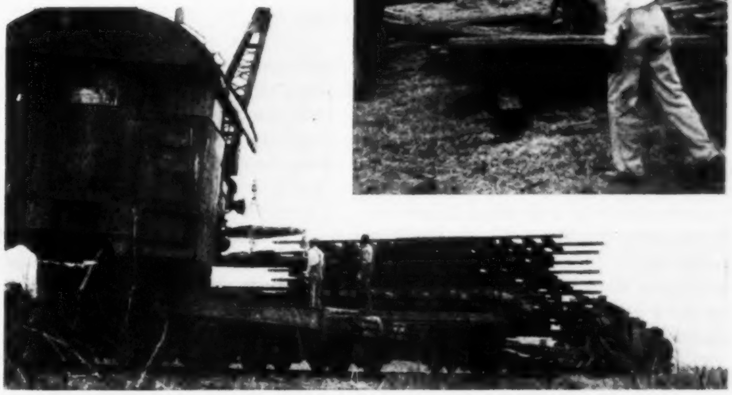
The experience of the Southern Pacific with this method has indicated that it is applicable in any case where the track is laid with square joints and particularly so where the recovery of ties reaches a high percentage. In this particular project 90 per cent of the ties were recovered for future use. Where the Southern Pacific has employed this scheme and at locations where it is proposed to use it in the future, there are no highways parallel to the right of way that would permit the ties to be salvaged by trucks, and the character of the country is such as to prohibit the use of trucks for this purpose where there are no highways. However, even though highways were conveniently available, officers of this road are of the opinion that where the tie recovery is heavy the use of trucks for salvaging the ties is more expensive than the method described.

In this project it was possible to use only one flat car in connection with the locomotive crane and as a consequence considerable time was lost in switching this car to and from the dismantling location. However, where there is sufficient work to justify it, officers of the Southern Pacific are of the opinion that the efficiency of the method can be increased by using several flat cars in connection with a locomotive crane of sufficient capacity to lift a flat car to and from the track. Specially fitted for the purpose, the flat cars could be set off along the track at the proper intervals so that when the car next to the crane became fully loaded it could be replaced by an empty one and the process repeated.

This method would permit the handling of as many flat cars as could be loaded in one day without the necessity of hauling any of them to the point of dismantling. The cars could be unloaded at night or another set could be taken out for loading the following day.

We are indebted for this information to E. A. Craft, engineer maintenance of way of the Southern Pacific Lines in Texas and Louisiana.

Left—Showing How the Lifting Frame Was Used in Taking Up the Track. Below—The Panels Were Placed Crosswise With the Car in Three Piles. Right—Where the Track Panels Were Dismanteled and the Material Classified and Loaded



Erie Reorganizes Its Track Forces

Smaller section gangs and specialized gangs fully equipped with power tools increase the efficiency and flexibility of the maintenance practices

KEEPING pace with current trends in maintenance, the Erie has effected a complete reorganization of track forces and maintenance methods. Differing in many details from plans which have been adopted for similar reasons by other roads, it adds another chapter to the accumulating record of reorganizations which have been made necessary by modern requirements in maintenance. An important purpose of the plan is to provide a balanced gang organization which can be fully equipped with power machines and tools to perform specific tasks, and which can, therefore, make the largest possible intensive use of this equipment.

In common with other roads, the Erie has found that the application of power equipment and tools in maintenance; the development of a wider roadbed, better drainage and improved ballast; and the increasing use of treated ties, larger tie plates, anti-creepers and heavier rail have resulted in stiffer track and have to a large extent changed the character of the work which the section forces are called upon to perform. Likewise, the longer service life which is being obtained from treated ties and heavy rail, the introduction of wholesale methods of weed destruction, the almost universal adoption of the track motor car, and many similar developments have so reduced the amount of routine work on the section that less men are required than formerly.

Status of Section Gang Changed

During the period of slightly more than two decades in which these transitions have been taking place on the Erie as elsewhere, the section gang has remained intact as the primary unit of the maintenance organization, although it had been recognized that its status was changing rapidly. In view of the necessity, which had long been evident, for a revision of methods to meet the needs of the new situation which had thus been created, the maintenance officers undertook an exhaustive study to determine the changes that would most nearly meet the needs of the railway as a whole. Basically this study was predicated on the desirability of using power tools, wherever practicable, as a substitute for the slower and more expensive methods of hand work. It was considered axiomatic that there would be no economy in providing machines for any operation unless it could be established that they would have a high use factor.

It became obvious at the start, therefore, that because of the many different kinds of work which the section forces must perform, it was out of the question even to consider providing the individual sections with the various types of machines which they would need if hand work were to be reduced to a minimum. While this study did not develop any satisfactory substitute for the section gang, it did show a pressing need for a more flexible form of organization than the one then existing, which had been carried over from an era when hand labor was employed exclusively. The next step, therefore, was to consider the possibility of forming specialized gangs which could be fully equipped and trained for particular classes of work. This appeared to meet the requirements, since gangs of this character might be expected to make the most intensive use of the power equipment provided for them. Furthermore, by consistently performing one class of work only, the men would become expert in the use of the tools and thus develop the maximum output from them.

How the Plan Was Developed

On this basis, then, the plan was developed. It consists essentially of more completely localizing the work of the section gangs and the assignment of special gangs which are properly equipped for the particular classes of work for which they are organized. It was not necessary for the success of the plan to make any fundamental change in the section organization. For this reason the form of the section gang and the length of the section remain unchanged, but the number of men in a gang has been reduced to conform with the amount and character of the work that they are now required to perform.

Heretofore, it has been the practice on the Erie to organize extra gangs for large ballasting operations only. All other program track work, as well as the routine requirements of maintenance, was performed by section gangs, which were enlarged or combined as the particular work in hand demanded. During 1932, however, this practice was changed and special gangs were organized to apply ballast, clean ballast, do general surfacing and perform other large or heavy maintenance tasks.

It is not the practice on the Erie to relay long stretches of rail at one time. Instead, from one to two miles are laid and surfaced before any more is laid. By following this method, the rail is surfaced promptly, so that the risk of damage to the unsurfaced rail by high speeds and heavy axle loads is practically eliminated. Furthermore, it is the experience on this road that the practice results in ultimate economy.

Obviously, this practice does not make it practicable to organize special gangs to lay rail. Under the new plan, therefore, this work is performed by an extra gang, either alone or with another gang added temporarily, which is engaged primarily in ballasting, but which is provided with the power equipment and tools necessary for laying rail. As soon as the required amount of rail has been laid, the gang drops back, renews and spaces the ties and applies the ballast.

Tie-Tamper Gangs a Feature

An important feature of the plan includes provision for special tie-tamper gangs to do general surfacing and relieve the section forces of this work which they were formerly expected to do. These gangs differ in size in accordance with the amount and importance of the work which is assigned to them. They are, therefore, designated as 4-tool, 8-tool, 12-tool, 16-tool and 20-tool tie-tamper gangs, respectively. They do no work other than general surfacing, giving the track a raise of one to two

inches as conditions warrant. Preceding each of these outfits, the section forces renew all ties, and, if conditions require, a ballast-cleaning gang with a mole or other suitable equipment cleans the ballast shoulder. As the tie-tamper gang progresses, therefore, and dresses and lines the track, it leaves the work in finished condition, so that the small section gang can easily care for it until another general surfacing is required.

One or more surfacing gangs are assigned to each division from April 1 to October 31. Since they are the keystone of the plan, the organization, methods and equipment of a typical 20-tool gang will be described.

A foreman, an assistant foreman, a compressor operator and 31 men constitute a gang for this number of tamper units. The foreman supervises the work of the

Three Views of Surfacing Work on the Huntington Division. Above—Raising the Track. At the Left—A 20-Tool Tamper Gang—All These Men Rode to Work Each Day in Automobiles. At the Lower Left—Tightening Up Bolts

gang and does all of the sighting necessary to raise the track. The assistant foreman handles the level board, looks after the setting of the spot board and assists in the supervision of the gang. The operator has charge of the compressors and is responsible for the moving of the pipe line.

Compressors Have a Range of 4,000 Ft.

When work is started at any point, two compressors having a combined capacity of 440 cu. ft. of free air a minute are set up 2,000 ft. in advance, and 2,000 ft. of 3-in. connected pipe extends from the compressors to the starting point. A similar line is laid 2,000 ft. ahead of the compressors with every second joint disconnected. These lines have ordinary pipe couplings at every second joint, while the alternate joints are fitted with Fons flexible pipe couplings. After the gang has progressed to a valve, which is located 1,000 ft. from the compressor, the operator having disconnected every second joint as the gang proceeds, the first 1,000 ft. of the pipe line is moved ahead of the compressor on a push car by the operator and one man. At this time 3,000 ft. of pipe line with every second joint disconnected is ahead of the compressor. After the gang has progressed to the compressor, the next 1,000 ft. of the pipe line is moved ahead, making 4,000 ft. of pipe line ahead of the compressor with every second joint disconnected. When the gang has progressed to a point 2,000 ft. ahead of the compressor, the second 2,000 ft. ahead of the compressor is connected up, the compressor is moved 4,000 ft. ahead and the cycle is repeated.

Air is delivered from the main to the tie tampers by means of two 1½-in. pipe manifolds, one for each side of the track, which have branch-line connections every 7 ft. 6 in. The manifolds are connected in turn to 1½-in. air hose 150 ft. long on the side nearest the 3-in. main and 165 ft. long for the opposite side of the track. It is thus necessary to break the connection with the main and make a new connection whenever the gang progresses 300 ft., or slightly less than once every hour of actual working time.

To reduce the time required to make the new connection, the end of the hose which is connected with the main is fitted with a 3-in. pipe nipple to which a Fons joint is attached. To break the connection, it is only necessary to drive out a key and separate the two sections of the joint. To make the new connection, these sections are fitted over the ends of the two pipes that are to be joined and the key is driven home. The total time required to break and complete a connection averages about 3½ min. Every morning the operator, assisted by the pipe men and the water boy, moves the pipe which was disconnected during the previous day, to a position ahead of the compressor.

From each of the branch connections in the manifold a ½-in. hose 12 ft. 6 in. long, with a Y-connection, leads to the individual tools. By this means, only five branch connections are required for the 10 tools served by each of the manifolds, and the number of fittings and the amount of hose required are reduced about half. Likewise the weight and complexity of the assembly are kept to a minimum, making it easier to handle as the surfacing progresses.

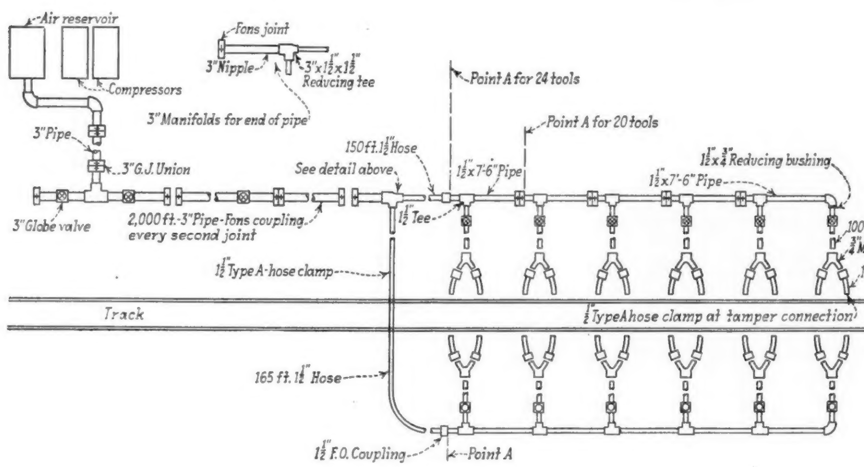
Eight jacks, operated by two men, are used for lifting

the track. Normally the jacks are set only at the joints and centers. The quarters are not lifted, except occasionally when this is found to be necessary as a result of bent rail or other causes. As soon as a lift is made, four men with ballast forks begin to fill in the cribs to insure an ample supply of ballast to complete the tamping. Two

One of the Fons Flexible Pipe Couplings in the Main Air Line

of these men also handle the hose and pull the manifolds forward as the tampers advance.

Immediately following are 20 tie tampers who work in pairs. This main group is divided into two smaller groups of 12 and 8 men, respectively. The 12 who are in advance tamp outside of the rail, each pair taking every third tie. They are followed closely by the smaller group which tamps inside of the rail, each pair taking every second tie. All ties are thus tamped "square," that



Equipment and Pipe Layout for the Delivery of Compressed Air to 20 and 24-Tool Gangs

is, the tamping is done simultaneously from the opposite sides of the tie. It has been found by experience that the 8 men doing the inside tamping can make the same progress as the 12 men who are working on the outside.

Behind this unit are four men. One tightens the bolts and shifts anti-creepers as necessary. Another taps down spikes and helps with the anti-creepers if necessary. The remaining two, who are designated as pipemen, dress the ballast behind the surfacing. An important part of their duties is to aid the operator in keeping the disconnected sections of pipe moved ahead.

This description of the organization and the method of working is based on the operations of a typical gang which has been employed on the Marion division during the season of 1932. It is one of five gangs in service on this division, the others being one 20-tool gang, two 12-tool gangs and one 4-tool gang. The gang which was visited was then advancing at the rate of 1,860 track feet a day or at the rate of 13.6 ft. per tool per hour actually worked. The accompanying table shows the results for 1932 of the operations of all of the gangs on the system and gives a comparison with the results of the previous year before the present compact organization had been perfected.

Gangs Are Self Contained

In organizing these gangs every effort was made to make them as nearly self contained as practicable. While the division motor-car repair forces are in general charge of the compressor and tool equipment, the operator is chosen for his skill in maintaining the machines and tools. The gang is equipped to care for the pipe line and connections, so that it does not need outside help to maintain this facility. Previously, it has been customary to send worn tamping bars to the shop for facing. This year an Ingersoll-Rand 4-K portable grinder was provided and the bars have since been faced on the site of the work. This can be done three times before they must be sent to the shop for reshaping. To insure continuity of the work, two spare tamping units and six extra bars are provided for each gang.

The rail on the section over which the gang in question has been working during the year, was laid in 1915, and owing to the conditions growing out of the war some of it had become surface bent. From the standpoint of wear, however, it appeared to be suitable for several years of additional service. The ballast also needed renewal, and it was evident that unless this was made it would be necessary to replace the rail in a short time. Accordingly, in 1931, the track was ballasted, the ties were renewed and head-free angle bars were applied to the joints.

While other conditions were noticeably improved, the inevitable settlement of the ballast and the bent condition of the rail combined to retain many of the surface defects. It was then decided to go over the track again in 1932, giving it a light running surface in the belief that these defects could be largely eliminated and the life of the rail conserved. Fortunately, the results have fulfilled all expectations, as the track is now holding its surface and it is believed that the life of the rail has been extended sufficiently to offset many times the cost of doing the work.

As stated at the beginning, ballasting has heretofore been the only program work for which special gangs were provided. All other work, including general surfacing, has been done by enlarged section gangs. The general plan for reorganizing the maintenance forces included a revision of the form and methods of the ballast-

ing gangs to provide for two types, thus giving more flexibility in this operation. The first type is for a balanced operation extending for three or more miles. The second is a medium-sized gang for minor work of this character extending for less than three miles.

The larger gang contains 75 men and is comprised of 1 foreman, 3 assistant foremen, 1 flagman, 1 water boy, 1 timekeeper and 68 laborers. The laborers are assigned as follows:

Unit Number	Character of Work	Number of Men
1	Cribbing	14
2	Renewing and spacing ties	6
	Gaging and spiking	4
	Tamping loose ties and adjusting anti-creepers	2
3	Digging jack holes	2
	Jackmen	4
	Tamping at jacks	4
	Filling in for tampers	4
	Tampers	16
4	Spotting and lining	6
	Tightening bolts and spikes	2
5	Finishing subgrade and dressing ballast	4

When the work is started, the men in Units 1, 2 and 3 work for the first two days at cribbing, and spacing and renewing ties. They are assigned as follows: One assistant foreman and 30 laborers cribbing, 1 assistant foreman and 26 laborers spacing and renewing ties. On the third, fourth and fifth days Unit 3 makes the first raise, completing about 1,400 ft. of track a day. On the sixth day it drops back and makes the second raise on the third day's work. On the seventh day it goes forward and makes a first raise in advance of the fifth day's work. On the eighth day it completes the track that was raised on the fourth day, and during the remainder of the work it continues to alternate in this manner between the first and second raises.

Units 4 and 5, which are in charge of one assistant foreman, are not started at work until the tenth day. In the meantime, such lining as may be necessary is done by Unit 3. One assistant foreman also has charge of Units 1 and 2, each of these four units being so constituted that normally it is able to advance at about one-half of the daily rate, or 700 ft., of the surfacing unit. The foreman assigns the number of cribs to be cleaned every day by each man in Unit 1. There are times, however, as in all operations of this character, when some of the operations get out of balance, and when this happens there is no hesitation in transferring men from one unit to another to keep the operation properly balanced.

The organization and methods followed by the smaller ballasting gangs are somewhat different. Each of these gangs consists of 1 foreman, 1 assistant foreman, 1 water boy, 1 flagman and 30 laborers. Since this type of gang is designed particularly to handle the ballasting on relatively short stretches of track, it follows that the procedure varies somewhat from that of the larger gangs.

On the first two days of the work at any point, the entire gang engages in cribbing and in spacing and renewing ties, the men being distributed as follows:

	Number of Men
Cribbing	16
Spacing and renewing ties	8
Gaging and spiking	4
Tamping loose ties and adjusting anti-creepers	2

On the third day, the entire gang drops back and starts raising. It should be able to finish the first raise or, if it is a light lift, to complete the surfacing of all of the track that has been cribbed on the first and second days. For this work the men are distributed as follows:

	Number of Men
Digging jack holes	2
Operating jacks	4
Tamping at jacks to hold lift	4
Tamping with the tampers	16
Filling in for tampers	4

Two days are again given over to cribbing and renewing ties, after which the gang drops back and surfaces. This sequence is followed until all of the surfacing has been done. When the surfacing has been completed, the spotting, lining, finishing the subgrade and dressing the ballast for the entire job are performed in one continuous operation. For this purpose, the men are then assigned as follows:

	Number of Men
Spotting and lining	14
Tightening bolts and driving down spikes	4
Finishing subgrade and dressing ballast	12

In general, the methods followed by the tie-tamper units when surfacing are substantially the same as those outlined for the surfacing gangs, except that the higher lift makes it desirable to tamp the ties adjacent to the jacks to insure the holding of the lift. This variation also makes it unnecessary to use as many jacks as is done on the smaller lift which is made during the general-surfacing operation.

General Surfacing Gangs—Statement of Feet per Tool per Hour Actually Worked and Feet per Tool per Day Actually Accomplished, With Per Cent of Increase 1932 Over 1931

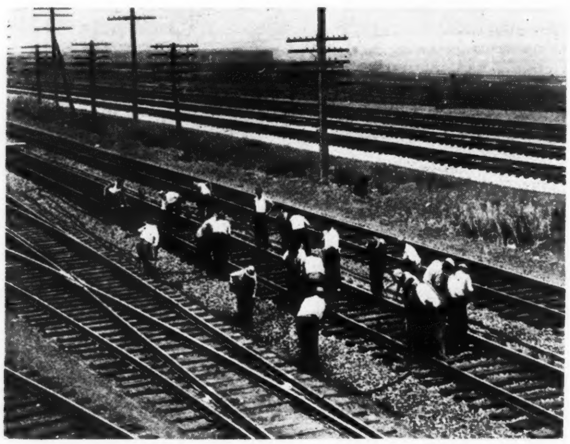
		Feet per Tool per Hour Actually Worked				Feet per Tool per Day Actually Accomplished			
District	Division	1931 Season	1932 Period	1932 To Date	Percent Inc. 1932 over 1931	1931 Season	1932 Period	1932 To Date	Percent Inc. 1932 over 1931
Eastern	New York	7.11	14.78	11.68	64.27	26.42	85.80	58.95	123.12
	Delaware	10.30	15.99	15.95	54.85	48.57	101.71	80.63	66.01
	Susquehanna	12.25	14.42	13.34	8.89	52.80	86.51	80.28	52.04
	Buffalo	10.91	12.39	14.24	30.52	52.14	92.25	82.75	58.71
	Average	10.49	14.37	13.69	30.50	45.70	92.11	76.20	66.74
Western	Allegany	6.62	15.85	12.89	94.71	56.00	79.25	86.42	54.32
	Meadville	8.92	14.34	12.78	42.79	43.66	95.32	84.24	92.95
	Mahoning	6.04	14.53	12.92	113.91	36.27	103.16	89.29	146.18
	Kent	7.04	15.44	13.82	96.31	42.08	86.46	84.60	101.04
	Marion	8.93	15.55	12.76	42.88	51.25	110.51	98.04	91.29
	Average	7.82	15.04	12.96	65.72	47.08	101.82	90.45	92.12
System	Average	8.62	14.78	13.20	53.13	46.57	97.83	85.02	82.56

What Has Been Accomplished

From an economic standpoint, no reorganization of forces or change in methods can be justified, particularly if it requires the application of mechanical equipment which represents a substantial investment, unless

the actual savings, as compared with the previous methods, are of sufficient magnitude to pay all of the charges and leave a reasonable profit. For this reason, the maintenance officers of the Erie have watched the results very closely during the year, comparing the productive output of the various gangs with the performance which has been obtained on similar work in previous years.

In making a study of the results, which are shown in the accompanying table and which refers particularly to the general surfacing gangs, it should be kept in mind that the comparisons are not between the present gangs and others which employed hand labor, but between gangs similarly equipped. The difference is that the forces employed on this work in 1932, were more compactly organized and utilized better methods, which reduced delays so that they were able to work more intensively on specific assignments. Furthermore, the plan specifically required that they do other work than that to which they were assigned. In this way every man has become more expert in the particular work he has to do, so that he is able to increase the output of the tools, and there is less internal lost motion than formerly. The experience this year indicates that still better performance can be expected in the future, as the division officers and foremen become better acquainted with the new methods and, therefore, more experienced in handling the forces.



One of the Tamper Gangs on the Eastern Lines of the Erie

Reduced Cost Only One of Benefits

Although the increased productive output of the gangs has resulted in a marked reduction in the cost of the work they have performed, this is only one of the benefits which has been derived from the new methods. The maintenance officers of the road are unanimous that higher standards of maintenance are being maintained while the character of the work is more substantial and of improved quality, factors which cannot always be given a dollar-and cents value, but which are definitely of consequence in considering the benefits of the plan.

Another phase of the matter, which still further adds to the savings which have been made, relates to the section forces. Since the heavy work of the season is being done by these special gangs, the ordinary section work, such as renewing ties, except where rail is laid or ballast renewed, spot surfacing, lining and the lighter routine work, is being performed by smaller section gangs. From November 1 to April 1, the extra gangs are discontinued. During this period also, the section gangs are reduced to a foreman and two men on main line sections and a foreman and one man on branches. The foremen are authorized to employ additional men temporarily, if necessary, to cope with storms or perform other emergency work.

The plan which has been described was developed by J. C. Patterson, chief engineer maintenance of way, and has been applied in co-operation with the engineers maintenance of way and division engineers of the system.

Roll Angle Bars From Scrap Axles

AFTER considerable experimental work, the Sellers Manufacturing Company, Chicago, is rolling high-carbon, hot-worked, oil-quenched steel rail-joint bars from scrap car axles furnished by the purchasers of the bars. Joint bars of standard types can be furnished to fit any rail section up to 100 lbs., but for heavier weights of rail, the sections are limited to those of narrow base flanges of the so-called toeless design, because of the small sectional area of the billets derived from the axles.

The axles used are confined to those of 5-in. by 9-in. and 5½-in. by 10-in. journal sizes, weighing approximately 650 lbs. and 750 lbs., respectively. The entire axle is rolled, being converted in one continuous operation, first into a square billet, and then into the finished angle-bar section. The heating is done in oil-fired furnaces, from 45 to 55 min. being required to bring the axles to the temperature of 2100 deg. F. required for rolling. The mill is equipped with a three-high stand of 24 in. roughing rolls, a three-high stand of 24 in. intermediate rolls, and a two-high set of 22 in. finishing rolls. The material is given six or seven passes in the roughing rolls to reduce it to an approximately square section, while the finished section is obtained by four passes in the intermedite rolls, and one pass in the finishing rolls. From the finishing rolls the bars go to the hot beds, and after cooling, are cropped and sheared to length. The blank bars are then shipped in carload lots to another plant where they are punched and heat treated. The present capacity of the mill is about 200 tons per day.

The joint bars are offered to meet the current A. S. T. M. specifications Serial A 49-21 for both chemistry and physical properties. Routine inspection reports covering commercial shipments to date indicate no difficulty in meeting these requirements. It is said, also, that all tests to date have shown a remarkable consistency in the relation of Brinnell to tensile readings.

While the chemical requirements for axles under the A. S. T. M. specifications for steel car axles are well within the range specified for high-carbon, hot-worked, oil-quenched splice bars, it is necessary to segregate the axles by carbon content so as to insure proper heat treatment of the bars. To do this requires a carbon analysis of drillings taken from each axle, and the separation of the axles into three groups, by carbon content, namely, 0.35 to 0.40 per cent carbon, 0.40 to 0.50 per cent carbon and 0.50 to 0.60 per cent carbon, all axles with a carbon content outside these limits being discarded. This segregation is carefully maintained throughout the entire process.

A new development in the splice bar manufacture is this company's practice of reforming or pressing splice bars, during hot finishing, into shapes to fit rail sections other than those for which they were rolled. This development makes it possible to provide bars to fit obsolete rail sections, where the tonnage involved does not warrant the manufacture of the necessary rolls.

Long Precast Bridge Slabs Erected Rapidly

The Completed Slabs for the St. George Bridge Being Moved to Temporary Position at the Bridge Site

Many features of interest in two new structures on the Canadian National and in construction methods employed

MANY precast reinforced concrete bridge deck slabs have been constructed by the railways of the United States and Canada, but it is doubtful if any more unusual and interesting slabs of this nature have been constructed than those built recently for two single-track bridges on the Canadian National in connection with grade separation projects. These slabs are of interest not alone because of their size and because they carry the tracks without ballast, but also because of the effectiveness and speed with which they were constructed and erected.

Slabs Afford Minimum Deck Depth

The two bridges involved include one at Sherbrooke, Que., over an extension of St. Francois street, and another near St. George, Ont., which replaced an old short girder bridge in a slightly different position over an important highway. The new bridges are designed for Cooper's E-60 loading and are essentially similar, consisting of two precast reinforced flat slabs, placed side by side continuous over a pier in the center of the street and supported at the ends on mass type abutments. The Sherbrooke deck, however, has two walkways, which are carried on reinforced concrete brackets poured integral with the deck slabs.

The slabs of the Sherbrooke structure have an over-all length of 53 ft. 6 in., providing an opening of 45 ft. between abutment faces, with two roadways separated by a center pier, while the slabs of the bridge near St. George have an over-all length of 58 ft. 10 in., and provide an opening of 52 ft. between abutments, equally divided by a center pier. The slabs of the Sherbrooke bridge are 24 in. thick, while those of the St. George bridge are 30 in. thick, about 6 in. thicker in the latter case than the slab design itself called for and added solely to simplify the bridge construction work.

Each of the two slabs of each bridge is 6½ ft. wide and is independent of the other structurally; also, each slab carries one track rail, dividing equally the train loads moved over them. Instead of ballast, each rail is laid on a creosoted oak cushion strip, set in a groove 5¾ in. wide by ½ in. deep, formed in the top of the slabs. The rails are held in place by special clips at intervals of 2 ft. along both sides, secured to the slabs by ¾-in. bolts which are turned down into internally-threaded pipe sleeves embedded in the concrete. Guards of 5-in. by 4-in. by ¾-in. steel angles, with the 5-in. leg up, are provided inside each rail, 10¾ in. in from the center-line of the rail, and are secured in place by bolts which screw into sleeves embedded in the concrete as in the case of the rail fastenings.

The slabs for both bridges are designed for the continuous beam action to which they are subject, and thus contain reinforcement for both tension and compression. In addition, they contain a series of old 56-lb. steel rails crosswise of the slab, to help distribute the loads laterally.

All of the main reinforcing is of square deformed bars of high carbon steel and is laid parallel to the longitudinal center line of the slab, no diagonal reinforcing being used. Of special interest with regard to the reinforcing is the fact that the specifications required that many of the bars be continuous for the full length of the slabs, without spliced or welded joints. Another feature of interest is the fact that the main reinforcing bars were assembled and welded into frames or trusses at the mill, using ½-in. plain square vertical ties. This was done to simplify assembly in the forms and, of still greater importance, to insure the greatest possible accuracy in this work, a feature that was particularly desirable because of the shallow depth of the slabs. It is said that the added cost of the pre-framing of the reinforcing cost less than ⅛ cent per lb. of steel, and that this added expense was offset completely by a saving of about two-thirds in the time which would have been required in assembling the individual bars in the field.

Detail of Joint Between Slabs

The joint between the slabs is of the lap type, with the top half of one slab projecting three inches over the bottom half of the other. Poured together on a continuous foundation, the slabs fit perfectly, with ⅜-in. clearance between the horizontal faces of the joint and a ½-in. opening between the vertical faces of the slabs in the top half of the joint. The ⅜-in. horizontal gap is filled with a 3-in. by ⅜-in. strip of sheet lead, forming a cushion bearing, and the ½-in. vertical opening is filled with asphalt mastic, with pre-molded asphalt fillers at each end.

To insure a positive watertight joint, 10-in. by ⅛-in. strips of lead were anchored in the tops of the slabs, paralleling the joint seam, and then, when the slabs were erected and the joint filled with mastic, these lead sheets were lapped over each other and soldered. Other than this the slabs are not waterproofed, reliance being placed in the density of the concrete to prevent any perceptible absorption of moisture.

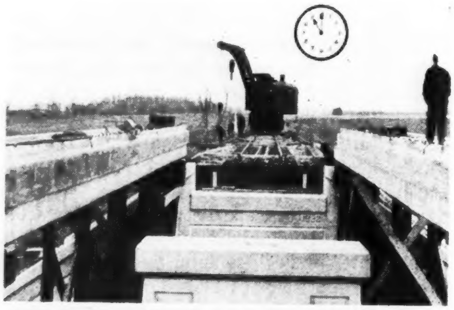
The slabs for both bridges were made in special forms

at the track level, as near the point of erection as possible. The forms were constructed of 2-in. tongue and groove sheeting supported on a foundation of 12-in. by 12-in. timbers placed on 4-ft. centers to prevent sagging. Furthermore, to insure the integrity of each slab with regard to the other, particularly at the longitudinal joint, the timber foundation was made continuous beneath both slabs, although only one slab was poured at a time. All of the reinforcing was hung from an overhead frame, precluding blocking beneath it, and each slab was poured in one continuous operation.

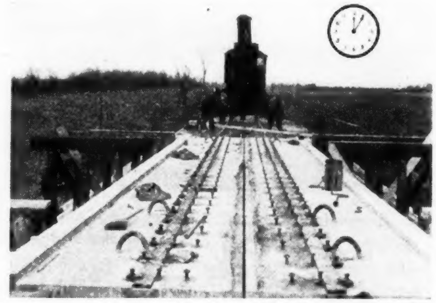
The slab with the lower projection of the joint was poured first and was allowed to set for 10 days before its accompanying slab was poured. When ready to pour each and those for the St. Francois street bridge required 53.4 cu. yd. each. In each case, the slabs were completed in one continuous pouring.

Two 150-Ton Cranes Set Slabs

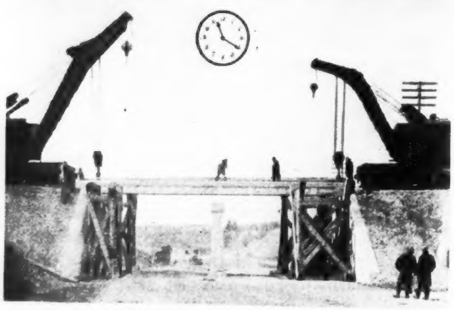
Erection of the two bridges was carried out in two principal stages. Preceding the placing of the concrete slabs, falsework was driven at the bridge sites to carry traffic while the necessary excavation and masonry were being completed. This falsework was extended on both sides of the bridges at the ends of the spans sufficiently to support the new deck slabs temporarily, preparatory to their being lifted into final position. When the slabs



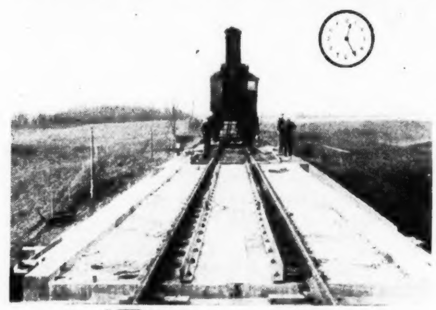
The Falsework Out and About Ready to Set in Slabs



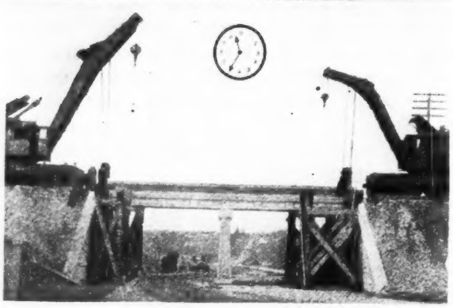
The Two Slabs in Place, Showing the Center Joint and Details of the Rail Seats and Fastenings



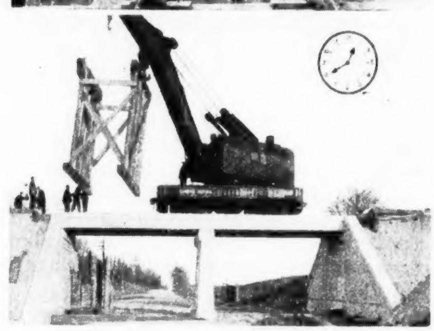
Setting the First Slab in Place



The Completed Bridge, Ready for Traffic, Showing Details of Track Fastenings



Placing the Second Deck Slab



The Bridge in Service and the Last of the Slab-Supporting Falsework Being Removed

Six Steps in the Placing of the Precast Slabs at the St. George Bridge

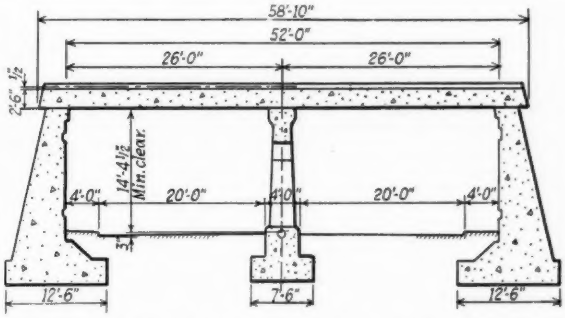
the second slab, the inside form of the first slab was removed, and then the exposed face, with suitable separators, was made to act as the inside form for the second slab. Before pouring the second slab, a greased board was laid up against the top half of the joint face of the first slab to provide for the joint opening between slabs; a thin zinc separator sheet was laid up against the lower half of the joint face; and a 3-in. by $\frac{1}{8}$-in. strip of sheet lead was laid on the horizontal face of the joint.

Three thousand-pound concrete was called for in the slabs, this being carefully proportioned and provided with an admixture of Celite to increase its workability. Calcium chloride was also added in quantities varying with the temperature, to bring about quicker setting. The slabs for the St. George bridge required 72 cu. yd. were completed and ready to be moved, those for the Sherbrooke bridge weighing 60 tons each and those for the St. George bridge weighing 79 tons each, they were picked up, one at a time, by two 150-ton locomotive cranes and first moved out and set in position on the extended falsework, one slab on each side of the track.

With adequate lifting capacity in the cranes and with special lifting stirrups having been provided near each end of the slabs to afford ready lifting holds, and so spaced as not to introduce objectionable erection stresses in the slabs, no difficulty was experienced in handling the slabs. However, because of the heavy concentrated loads on the front trucks of the cranes while handling the slabs, the precaution was taken to consolidate as much as possible the embankment approaches to the bridges in

order to prevent settling of the track with the difficulties which might result. It is said that if it had not been for the danger of the embankment approaches giving way under the crane loads, the entire deck of each bridge might feasibly have been cast and erected as one slab instead of two, the cranes having ample capacity.

The final placement of the slabs on the newly constructed abutment and piers was accomplished between trains, just as was the temporary placement of the slabs on the erection falsework. At an appointed time, the bridge track and the temporary deck and bridge falsework were removed with the aid of the cranes, and then, one at a time, the slabs were raised from their falsework supports and swung over and set in final position on the new abutments and center pier. Sheet lead bearing pads,



A Longitudinal Section Through the St. George Bridge

¼-in. thick, were placed beneath the slabs on both the abutments and the pier, and the 3-in. by ⅜-in. strip of sheet lead called for in the joint design, and used temporarily during the pouring of the slabs, was laid on the horizontal face between slabs.

As soon as the slabs were set in place, the joint was poured with asphalt mastic and the lead sealing sheets on top were lapped and soldered, as provided for. While this work was progressing, the crane crews removed the falsework bents which had supported the slabs temporarily, and other men in the gang set in the track rails on the oak cushion strips which had previously been put in place.

With the tightening of the rail clip bolts and the removal of the last falsework from the roadway beneath, the bridge was put in unrestricted service. In the case of the St. George bridge, the work was completed in 2 hr. 10 min. after the track had been taken out of service. The work was not hurried at any stage, traffic not requiring the return of the track to service for some time after it was actually restored.

Details of the schedule assumed in the work are given in the following:

Preparatory work on slabs completed and track taken out of service at .... 10:30 a. m.
Track and bridge falsework completely removed by.... 11:00 a. m.
First slab set in place by........ 11:20 a. m.
Second slab set in place by........ 11:35 a. m.
Deck ready to receive rails by........ 12:05 p. m.
Track and guard rails in and most of falsework removed by .... 12:25 p. m.
Last falsework removed and track restored to service at .... 12:40 p. m.

The erection of the bridge at Sherbrooke was not timed in detail, but it is said that the work at that point was done just as effectively as that in connection with the St. George bridge, and, in fact, that the actual time required to place both slabs of the Sherbrooke bridge was only 20 min.

The slabs of the St. George bridge cost a total of $1,140 each, while those for the Sherbrooke bridge, including the walkway brackets, but not the walkway slabs, cost a total of $1,305 each.

The bridges were designed in the bridge department of the Central region of the Canadian National, Toronto, under the direction of C. P. Disney, bridge engineer; T. T. Irving, chief engineer; and W. A. Kingsland, general manager. The deck slabs were manufactured by the Goldie Construction Company, Ltd., Toronto, while their erection was handled by company forces under the direction of R. A. Baldwin, engineer of construction.

Are Water Stations Obsolescent?

(Continued from page 366)

cent on the Great Northern during the last 10 years," was the report of J. R. W. Davis, chief engineer of that road, which has constructed 70 new stations and rebuilt or remodeled more than 300 others since 1913. Putting the results on another basis, E. M. Grime, engineer of water service of the Northern Pacific, reported that after allowing for operating and carrying charges, "the plants we have modernized in recent years are showing a return on the investment of approximately 40 per cent." Still further evidence was submitted by J. A. Russell, manager of water service, of the Pennsylvania, which road "has rehabilitated many water stations in recent years, generally by the installation of automatic motor-driven pumping equipment. Definite economies were assured for each project before it was authorized. For the system, the maintenance of water stations per locomotive mile in 1932 was only 50 per cent of what it cost in 1929."

Is the Job Finished?

Have all of the improvements in water-service facilities that will be warranted in the near future been completed? Or is modernization a task that must be continued? While a few officers are inclined to believe that they have finished the job, others recognize that there is still opportunity to improve service or further reduce costs. Mr. Kirkbride voiced the belief of this majority in his comment that "although much improvement work has been done in the past, our engineers and technical experts are keenly alive to further progress in this field, as it is one of the important basic features of the operation of any steam railway."

Also looking to the future, W. A. Murray, engineer maintenance of way of the New York Central Lines East of Buffalo, observed that "although we began the installation of water softening plants as long ago as 1910, only a small part of our total consumption is being treated. We expect to do more along this line in the future."

In a similar vein Mr. Barnes remarked that "although we have been carrying on a large program of modernization for more than 12 years, we still have considerable work to do. We are operating steam plants that should be converted to oil or electric power, and we should install additional treating and sedimentation plants."

While other examples to illustrate this attitude of railway officers might be given, these are sufficient to indicate that past experience leads them to believe that changing conditions of operation and advances in equipment and processes may be expected to make many of even the most modern stations obsolete within a few years, and that the development of water service facilities is a continuing process which must be repeated as often as new developments of merit arise.

What's the Answer?

Have you a question you would like to have someone answer?

Can you answer any of the questions listed in the box?

> ### To Be Answered in October
>
> 1. *What causes corrugations on the running surface of rail? What can be done to prevent or correct it?*
> 2. *What should be the relative height, as compared with the running rails, of the inner guard rails on bridges? Why? How far should they be placed from the running rail? What determines this distance?*
> 3. *Should a section gang that is doing routine surfacing or making a light renewal of ties be required to fill in and dress the track at the close of each day's work? Why?*
> 4. *What is the most satisfactory method for replacing broken tile in tile roof?*
> 5. *How far from the lining gang should a foreman stand when lining long swings on tangents? How close for finished lining? Why? Where should he stand when lining curves?*
> 6. *What are the relative advantages and disadvantages of rotary pumps? What is their efficiency as compared with other types? For what service is the rotary pump best adapted?*
> 7. *Where the section forces are limited, how much time should be devoted to burning and otherwise clearing the right of way in preparation for winter? Should this be done as a special job or in connection with other work? Why?*
> 8. *What methods are necessary and what sequence should be followed in replacing or driving additional piles in bents of ballast-deck timber trestles? Are these different for high and low bents? Why?*

Sawing Piles Under Water

When it becomes necessary to saw piles off under water to provide an even bearing for sills or other timbers, how can this best be done ?

Depends on Depth of Cutoff below Surface

By Supervisor of Bridges and Buildings

If the elevation of the cutoff is within a few inches, say not more than a foot, of the surface of the water, the cutting can be done in the ordinary manner by hand with a cross-cut saw. While the piles can, in case of necessity, be cut off in this manner at somewhat greater depths, it is slow and difficult work. Furthermore, as the depth increases, the ability to guide the saw properly is decreased and it is less likely that an even bearing will be provided for the timbers.

Where only a few piles are to be cut off at a depth which permits, hand sawing is generally to be recommended, unless the water is too cold to work in. If a large number of piles are to be cut off, the hand method becomes too expensive, while it may also delay the work, since it may progress quite slowly. In relatively shallow water, say up to two or three feet, I have found that a jig will do the work about as satisfactorily as any other equipment. A jig consists of a cross-cut saw held rigidly in a movable frame. It may either swing like a pendulum or be supported on horizontal guides in such a manner that it can be given a reciprocating motion.

To operate the jig, four or more piles, as may be necessary, are cut off by hand and fitted with timbers to support the carrying frame from which the jig is operated. These timbers are given the proper elevation and the jig is moved from pile to pile as far as it will reach. As additional piles are cut off, the permanent timbers can be applied and used in turn to extend the radius of action of the jig. Great care should be exercised in every case to insure that the cutoff is made in a horizontal plane, and that all of the piles in any group are cut off at exactly the same elevation, in order that the superimposed timbers shall have an even bearing on each pile and a uniform bearing on all of them.

Where the cutoff must be made at a greater depth, it becomes necessary to provide other means to do the work, since both the jig and the hand methods are adapted for only shallow depths. In this event, it is usual to rig up a circular saw on the end of a vertical shaft, which is so arranged that the saw can be lifted above the surface or lowered to the elevation of the cutoff at the highest stage of the water. This method requires rather elaborate preparations as either a steam engine or an internal combustion engine is required to operate the saw. The shaft must be held rigidly while the saw is in operation. This requires a stiff heavy frame and a mechanism for raising and lowering the shaft and for holding it securely at the desired elevation during operation.

Circular Saw Provides Best Means

By Engineer of Bridges

It is my experience that a circular saw attached to the lower end of a vertical shaft provides the most satisfactory means for cutting off piles under water where this must be done at any depth or where a considerable number of piles are involved. If only a few piles are to be cut off and the cutoff is close to the surface of the water,

it may be satisfactory to cut them by hand. While this method is generally feasible, the unit cost is usually so high that it cannot be recommended, except for comparatively small jobs where the cost of setting up the power equipment will be equal or greater.

A circular saw for this purpose can be used in two ways: From floating equipment where the depth of the cutoff is greater than the draft of the barge; or for shallow depths, from a rigid but movable frame which is supported on the piles. Coffer dams frequently offer considerable difficulties with respect to a proper support for the shaft and the saw, owing to the amount of bracing and the necessity of moving the saw from compartment to compartment. For this reason, if the piles can be unwatered, it is generally better to cut them off by hand.

Since the question stipulates that the piles under discussion are to support sills or other timbers, it is important to insure that every pile does its full share of the work. To this end, each cutoff should be in a horizontal plane and every cutoff in the same plane. This can be accomplished only by the most careful supervision of the operation. If it is done by hand, the usual methods can be applied. If done by a circular saw working in a frame which is supported on the piling, the elevations can be given by an engineer's level and markings on the shaft. If from floating equipment, a levelman should be in constant attendance to detect any variations in the elevation of the saw and signal adjustments to the operator. Many hundreds of piles have been cut off in this manner in 20 ft. or more of water with variations in elevation not exceeding 1/8 in.

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Sodding Slopes

From the standpoint of maintenance, what advantages, if any, are there in sodding slopes in cuts and on embankments? How can this best be accomplished ?

Sodding Minimizes Erosion

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

It has been my experience over a period of many years that there is a definite advantage in sodding slopes, especially where the work is new. Newly-opened cuts and newly-placed embankments are especially susceptible to erosion, particularly if the soil is sandy. A single storm or a series of storms may create extreme damage and require expensive repairs in the way of refilling the washed places with train-hauled materials. In cuts, the wash may fill the ditches, ruin the ballast and require expensive ditching. While sodding is not a cure-all and cannot be employed as a substitute for either surface or subsurface drainage, many of the ills of erosion can be completely cured by properly sodding the slopes.

In the southern states, Bermuda grass is a most effective agent for protecting slopes. It can be planted in the spring by spading a small hole for the plants, spacing them about one foot apart in staggered rows. In many locations all of the plants that are needed can be obtained on the right of way and distributed by push car or work train, as the magnitude of the work requires.

In some places, particularly on steep embankments, it may be desirable to set out small black locust trees, spacing them over the surface of the embankment in staggered rows about four feet apart. The roots of this species spread rapidly where conditions are favorable, and this definitely aids in holding the earth in place and in retarding erosion. If the trees and the sod are both employed, the surface becomes almost rainproof.

Sodding Decreases Ditch Maintenance

By J. B. WILSON

Section Foreman, Missouri-Kansas-Texas, Denison, Tex.

One of the principal advantages of sodding the slopes in cuts is the marked decrease in ditch maintenance which results. It also materially improves the appearance of the right of way. To obtain the best results, the surface to be sodded should be worked to as gentle and smooth a slope as is practicable during the winter or early spring and sodded with native grasses. This can be done by placing small squares of sod every two or three feet, or as close as time and the available supply will permit. Preferred attention should be given to the foot of the slope.

Embankments should be treated in the same manner and a ditch should be provided far enough from the toe of the fill to carry away rainfall and thus prevent saturation and softening of the ground at this point. The ditch should be as shallow as practicable to insure against movement of the soil toward it. Local conditions are generally the determining factor and should be accorded their proper place. Correct drainage and a well-sodded embankment will often overcome troublesome sloughing of slopes that have been chronic offenders.

Term Sodding Sometimes Misunderstood

By District Engineer

On the road with which I am connected, the economic advantage of sodding is considered debatable. Apparently one of the reasons for this attitude of doubt on the part of certain officers is a misconception of the meaning of the term. As they visualize it, they think of the placing of scalped sod, such as they have seen done on lawns, and not of the slower but equally effective method of seeding. As a general practice, however, I am most heartily in favor of sodding. My experience has taught me that the sodding of slopes is a decided advantage from the physical point of view and that the practice often pays exceptionally large dividends. In fact, I have known more than one instance where it has more than paid for itself in a single storm.

While sodding is not a panacea for any of the evils of improper drainage, it is frequently of real assistance in preserving surface drains. Where the soil erodes easily, the sodding of the cuts may make it practicable to maintain the slopes with little washing and thus enable the ditches to function properly when they are most needed—during and immediately after a storm. Similar benefits in the elimination or retardation of erosion on the slopes of embankments are the common experience of those who have taken measures to promote the sodding of these surfaces.

A sodding procedure may be fully effective in one situation and a complete failure in another, for the reason that local conditions of soil, vegetation, drainage, climate, etc., exert a definite influence on the results that may be expected from any particular method. Certain fundamental considerations are common to all cases, however. Among these, all unstable material that is likely to slide or collapse should be removed. A slope from which water seeps should be drained by means of bleeders. The slope to be sodded should always be made smooth and as flat as practicable; a steep slope is seldom favorable for growing sod.

In some cases satisfactory results can be obtained only by the placing of the sod; in others, this method may be necessary because time does not permit the slower method of seeding. Where conditions are favorable, and this occurs in the majority of cases, sowing the seed of native grasses will give satisfactory results at least cost. Bermuda grass easily becomes a pest, especially where it obtains a foothold in the ballast, but for sodding slopes in sections where it will grow, it has no superior. Usually an ample supply can be obtained on the right of way and by planting the roots at, say, one-foot intervals, one can have a respectable growth the first year and a dense sod thereafter.

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Varying Water Stages

Where fluctuations in a stream or reservoir are greater than the practicable suction lift, what means can be employed to insure a dependable delivery of power and continuity of pumping ?

Deep Water-Tight Pits Afford Solution

By J. H. DAVIDSON
Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

One of the most satisfactory methods of meeting the situation outlined in the question is to construct a water-tight pump well, or pit, of sufficient depth so that at the lowest level of the water supply, pumps placed on the bottom of the pit will have a practicable suction lift. It will be necessary to select the pump and motive-power unit so that when the water level is high and a positive head exists on the suction line, the motive-power unit will not be overloaded.

Various types of pumps and of motive power can be used in such a pit. If it is desired to use steam pumps, the size of the pit can be made to accommodate the pumps, but the steam generating plant should be placed outside and above the high-water level. Electrically-driven centrifugal pumps are especially adapted for a situation of this kind, owing to the small space they occupy as compared to other types of pumps.

Perhaps the most serious objection to a pump pit of the kind suggested is that it is usually expensive to construct. As an alternative, one southwestern road has made use of deep-well turbine pumps, properly designed for pumping from reservoirs where there is considerable fluctuation in the water level. These are driven by either electric motors or internal combustion engines. While pumps of this type cost more than those of other types having equal capacity, this is more than offset by the saving which results from avoiding the construction of an expensive pit. These deep-well turbines are usually mounted on a platform supported by piling which are driven into the bottom of the stream or reservoir.

Three Methods Are Available

By R. C. BARDWELL
Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

There are three methods in general use for taking care of pumping situations where the fluctuation in stream flow or reservoir level is greater than the practicable suction lift. Obviously, the power units must be kept above high water or suitable protection provided to prevent flooding. The dependable method for both operation and maintenance is to install suitable concrete dry wells with the top above maximum high water and the bottom within 15 ft. of minimum low water. This will permit the use of standard shallow-lift pumping equipment which can be operated on automatic control. The parts are also readily accessible for repairs. Such installations are in service on the Chesapeake & Ohio, along the Ohio river; on the Great Northern, along the Columbia river; on the Louisville & Nashville, along the Licking river; and on other roads along streams having wide fluctuations. The first cost is usually relatively high, but where dependability is an essential factor, such installations are warranted.

A second method is to provide movable units which can be raised or lowered on inclined tracks, or by some other suitable method, and connections made to suction and discharge lines at convenient levels, whenever the rising or falling of the stream requires such changes. This method requires check and watching, especially during the rising stage in streams of rapid fluctuation, to insure that changes will be made in the pump setting before damage can occur to the equipment. A good example of such an installation is that on the Southern at Ludlow, Ky.

Where steam pumps are used in locations of this character, it is sometimes advisable to install the boiler plant well above maximum high water and run steam lines to a series of pumps that are set permanently at convenient elevations, between high and low water. In this case, during high-water stages, the lower pump or pumps are submerged and require careful cleaning and overhauling when the stream recedes or returns to normal stage, but this method is far more dependable than that of raising and lowering heavy steam equipment.

A third method consists of the use of deep-well turbine pumps, with the power units set safely above high water. Obviously, the pump bowls must be submerged at even the lowest stages. In cold climates, installations of this character require rather costly provisions for protection against freezing. In warmer climates, there are installations in service where the necessity for a dry well or a special intake tower has been obviated by setting the deep-well turbine-pump motor and discharge head on the bridge across the stream which is the source of supply, with the pump bowls submerged in the stream. Bridge vibration has caused some trouble in some of these installations and generally repairs are more difficult and expensive to make than they are to horizontal suction-lift pumps, which can be used in a suitable dry well.

Several Methods Are Available

By Engineer of Water Service

As a rule, the suction lift of pumps should not exceed 18 ft., although lifts of 24 to 26 ft. have been made successfully. Where the variation between high and low water in streams and reservoirs is wide, these limitations as to suction lift sometimes present problems difficult of solution with respect to the design and location of the pumping facilities. Obviously, when conditions of this character are encountered, it is necessary to lower the pump to a point within the suction range of extreme low water. The method employed will depend largely on the type of pumping equipment to be used.

One of the earliest methods was to construct an inclined track along the bank of the stream and place the pump on a car which was raised or lowered on the track by means of a cable and winch as the water rose or fell. This method was very popular and is still used frequently on the rivers of the South where there is a wide range between high and low water, and where the question of frost protection is of little importance. In some cases the pump is housed on the car and the steam

and water connections are insulated against frost. This method has been confined very largely to steam pumps. Connections placed at intervals along the incline permit the steam and water lines to reach the pumps through flexible couplings.

Probably the most satisfactory solution where the water level fluctuates widely, and which offers the least chance of interruption of service, is to place the pumps in a waterproof pit which extends from within the range of practicable suction lift at extreme low water to a point safely above maximum high water. If the pumps are electrically driven, both the pumps and the motors can be placed at the bottom of the pit. Steam pumps can similarly be placed and operated successfully, even though seepage or accident may cause them to be submerged. If the power unit is an internal-combustion engine, it should always be placed outside of the pit and the pump driven by means of a belt, to avoid an accumulation of noxious gases. In some cases, however, where triplex or other types of power pumps have been used, the drive has been through extended shafts with a power head located at engine level.

Probably the only objection to large pits of this kind is their high cost, particularly in unfavorable locations where ground conditions are unstable or the excavation must be made through rock. This may make it desirable to adopt other methods. An alternative is to reduce the size of the pit to the smallest practicable dimensions and select special types of pumps to meet the requirements. The deep-well turbine is well adapted to conditions of this kind, since it can be installed independently of a pit or shaft. The pump can be located at the water level or submerged as desired, provided the power unit is located at any convenient point above extreme high water.

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Maximum Lift for Track

When giving the track a heavy raise, what is the maximum lift that should be permitted? Why ?

No Set Rule Can Govern All Conditions

By THOMAS WALKER

Roadmaster, Louisville & Nashville, Evansville, Ind.

As I see it, no set rule can govern all conditions. One must consider the force available, the amount of ballast, the density of traffic, the weather conditions, etc. For the average small section gang, such as now prevails, the raise should not exceed six inches, and the work should be done under the protection of stop signals. Such a raise should never be attempted in very hot weather when there is danger of the track buckling.

Where the gangs are larger, heavier raises can be made if necessary, while under certain conditions they can be made to the full capacity of the jacks. Obviously, this should be done under proper protection, and it may result in delays to trains, unless the work is carried on in close co-operation with the dispatcher, which often is not practicable. The number of trains on the line is an important factor, since delays to trains should be avoided. If runoffs must be made frequently to let trains over heavy lifts, the work will be slowed up considerably.

As a regular thing, very heavy raises should not be encountered in the general run of surfacing. For this reason, I consider that they should be treated as special work and that the limit of the lift should be governed entirely by local conditions.

Maintenance Does Not Require Heavy Lifts

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

I look upon this question as one worthy of the most serious consideration on the part of general and division officers alike. Design of track and roadbed materials, methods of maintenance and equipment for performing maintenance operations have been perfected to the point where it is now practicable to keep our tracks in condition for any reasonable speed or loading without the constantly recurring necessity for heavy installations of ballast. At present, therefore, I consider that track should not be given a heavy raise for purely maintenance purposes.

If cases do occur where for any reason heavy lifts become necessary, the banks should be widened and cuts cleaned and ditched where needed and advance preparation made for tie renewals, slow orders, etc. Special attention should be paid to the distribution of the ballast and the plowing of it off of the track to minimize the work of tamping. At points where only a light raise is necessary, the track should be well cleared of ballast to reduce the amount of labor involved in digging the jack holes and preparing the cribs for the actual work of tamping. As the height of the raise increases, there should be sufficient ballast to complete the tamping and fill the cribs enough to insure that the track will stay in line under high-speed trains.

In general, heavy raises should be made in two, three or even a larger number of lifts, exclusive of the final surfacing, as may be found most suitable for the height. New ballast rarely settles uniformly, and the greater the lift the more aggravated the effect of this characteristic. When a single high lift is made, the track may be thrown considerably out of line unless extreme care is taken. The tendency is to get ballast unevenly under the ties, with the result that as settlement occurs the surface is more or less irregular, the track is likely to become out of level and it is usually thrown farther out of line. Both observation and experience have convinced me that we will gain in the long run if heavy raises are made in increments of four or five inches, with ample time between succeeding lifts for proper settlement by trains, with a final lift of about two inches for the finished surface.

Should Be Done in Two or More Lifts

By J. B. WILSON

Section Foreman, Missouri-Kansas-Texas, Denison, Tex.

When ballasting on a new roadbed, six or eight inches should be the maximum for any one lift. If a higher raise is required, it should be made in two or more lifts, with sufficient time between for settlement. On an old settled roadbed that has a good bed of well-compacted ballast, a lift 10 in. or even more is feasible and can be made safely. If smooth-riding track is to be maintained, however, I would divide the raise and make it in two or more lifts. If this is done, less subsequent maintenance will be required.

Makes Nine Inches the Limit

By W. E. TILLETT

Assistant Foreman, Chesapeake & Ohio, Maysville, Ky.

When raising track out of face, it is our practice, which we find very satisfactory, to make only one lift up to nine inches. If the raise exceeds this, we make it in two or more lifts. It is our experience that where the

track is lifted more than this amount, the ballast does not compact uniformly and the track shortly becomes choppy as to surface, with the probability that it will also become more or less out of level. In making more than one lift, the final lift is always less than those that precede it.

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Insulating Ice Houses

What is the most satisfactory method of insulating the exterior walls of ice houses? How should the work be done? What precautions are required ?

Requirements for Northern Climates

By J. W. ORROCK

Engineer of Buildings, Canadian Pacific, Montreal, Que.

Satisfactory methods for insulating the exterior walls of ice houses depend in large measure on climatic conditions and the cost of ice. Where ice is plentiful and cheap, it is to be expected that the buildings will not be so carefully constructed as in sections where it is expensive. For the same reason, insulating methods for the exterior walls will vary considerably. Walls that are quite satisfactory for our latitude will generally be entirely inadequate in the South.

Canadian Pacific practice calls for double-air-space wall construction. This consists of outside siding, a layer of tar paper, a course of 1-in. sheathing, a 10-in. air space formed by 2-in. by 10-in. studding, another course of 1-in. sheathing, a 6-in. air space formed by 2-in. by 6-in. studding, and a third application of 1-in. sheathing. The whole assembly is supported on a wooden sill footing made up of 3-in. by 10-in. by 3-ft. material spaced to bring a support under every third wall stud.

It has been suggested that if the 10-in. space were filled with wood shavings, a greater degree of efficiency might be obtained at little extra cost, and when size or other factors warrant, concrete foundations may replace the wooden sills. Owing to the climatic conditions under which most of our ice houses are operated and to the low cost and bountiful supply of natural ice, however, we have found it economically advisable to follow the foregoing practices.

Probably the weakest feature in all ice houses is the doors. If they do not fit tightly, are left open or only partially closed, the shrinkage of ice will be considerable. The conduction of heat through the ground is another cause of shrinkage. For this reason, a good concrete wall, four or five feet deep, all around the house is recommended to prevent heat reaching the floor of the house through this channel.

Would Use Commercial Insulation

By A. T. HAWK

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

In the past various types of construction which have given varied results have been employed for ordinary ice houses which were built to store natural ice for railway use. Years ago we insulated ice house walls by filling the spaces between the studs with dry sawdust. Later we tried to improve on our former practice by building walls with dead air spaces. To do this we placed cleats between the studs and sheathing between the cleats, with tar paper applied directly on the different layers of sheathing. Outside of the studs we also applied one or more plies of sheathing with furring strips and insulating paper between. The results from this type of construction were not good, however, owing to the shrinkage of the materials after the house had been in service for some time. This, of course, eliminated the dead air space we were trying to obtain and we had serious shrinkage of the stored ice. It is quite likely that we can obtain a much better wall by using several thicknesses of insulating board, of which there are a number on the market, nailed directly to the sheathing.

My idea of the proper construction of an ice-house wall, which has the added advantage of low initial cost, is to use 2-in. by 12-in. or 3-in. by 12-in. studding, spaced 2 ft. apart, with sheathing on each side. The spaces between the studs should be packed tight with dry sawdust. One row of sheathing boards inside of the house at the top of the studding should be omitted, so that dry sawdust can be added as needed to care for the shrinkage that always occurs in the sawdust packing. Next apply a 1-in. thickness of some dependable insulating board to both the inside and outside sheathing. Mop the insulating board with hot asphalt and, while hot, apply a real insulating paper. For the outside or protection course apply 1-in. by 6-in. D and M lumber on the inside of the house and drop siding on the outside.

If the ice house is to be built on a concrete foundation or is to be supported on creosoted pile butts, the sills, plates and studding should be treated with creosote or other preservative. All of the sheathing and lining should be treated with ZMA or other preservative, since untreated lumber in an icehouse wall deteriorates rapidly owing to the constant presence of moisture.

To keep shrinkage of the ice to a minimum, it is essential that the top part of the roof be ventilated effectively, and that the roof also be insulated, though it is not necessary to do this to the same standard as the walls.

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Laying Rail in Strings

What are the relative advantages and disadvantages of laying rail in strings as compared with laying single rails? What precautions should be taken ?

Disadvantages Outweigh Advantages

By C. W. BALDRIDGE

Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

In my own experience the laying of rails in strings has been done only where comparatively short stretches of track are to be laid and only a small gang is employed. In such cases it has been done to minimize the interference with traffic by having the track open as little as possible.

The advantages of this method in such cases are that the new rail is set up on the ties with the joints fully bolted. The spikes on one side of the old rail are then drawn, the rail is lined over and the new rail lined to replace it. To avoid regaging, the outside spikes are usually drawn so that the new rail is spiked in place and to gage at one operation, thus closing the track more quickly than would be possible if the track were opened first and all of the work of placing the new rails one at a time and jointing them were done before the track could be closed. This seems to be about the only advantage of this method, since rails laid one at a time can be laid against whichever line of spikes is desired, even more easily than a long string of rails.

Among the disadvantages, there is greater danger of kinking and bending the rails as they are being lined to place in long strings. It is scarcely possible to install them in this manner without disarranging the temperature spacing, which is usually increased as there is a tendency to pull the rails apart as they are lined over. Furthermore, one string of rails, either the new or the old, must be between the gage lines for a time during the operation for if the new rails are set up outside of the track, they will be in the way of pulling the spikes. Also, the old rail must then be lined in while the new rail is being installed and then be lined out over the new rail to get it out of the way. The alternative is to let the old rail stay between the gage lines until it is uncoupled and then lift it out of the track, one at a time. On the other hand, if the new rails are set up on the inside of the track they may foul low-hanging brake beams or other rigging, and they must be lined out past the inner row of spikes and then lined back into place, with still greater risk of being bent or kinked.

This method is impracticable unless the old and new rails are of the same section or have the same relation between the edge of base and the gage line. There is little, if any, advantage in laying rail in strings where plenty of men are available, particularly if a suitable unbolting machine is part of the gang equipment. In fact, in this event the advantage is decidedly on the side of laying the rails singly. Precautions which should be observed include care to avoid kinking the rails as they are being lined into place and provision to protect against fouling by brake rigging or other parts of cars while the rails are between the gage lines.

Rail Can Easily Be Damaged by This Method

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

When laying rail in strings, all of the work of installation must be done by hand, the old rail being lined out and the new rail lined in by means of lining bars. It is my experience that it is surprisingly easy to damage rails by throwing kinks into it during this operation. Some, and often a considerable number of these kinks, cannot be detected by eye until the rail has been in service for some time. As I view the matter, with all of the modern power equipment we have at our disposal for performing the various tasks in connection with laying rail, there is little reason today for laying rail in strings. Setting the rails in singly with a rail crane substantially eliminates the probability of damage to the rail and reduces the hazard of personal injury to an almost negligible position.

Rail Cranes Have Superseded This Method

By J. B. WILSON

Section Foreman, Missouri-Kansas-Texas, Denison, Tex.

While this practice was a common one some years ago, and is still in vogue where intervals between trains are very short, it has been generally discontinued where the work is being done under normal conditions. This change has been brought about largely through the wider use of rail cranes which are able to handle the largest sections of rail with ease. It is easy to understand the advantages of this method in a busy terminal, since the time of the gang can be conserved and the rail can be "swapped" during the limited time between trains.

Even here, however, the work must be done so hurriedly that there is little opportunity for correcting details which make the difference between a good job and a poor or indifferent one. These include proper adzing to insure an even bearing, first-class gaging, and the probability of affecting the uniform distribution of the expansion allowance. If the rails are laid singly by a well-trained gang, it is surprising what short intervals between trains can be utilized to advantage, and how much better the foregoing details will be observed and cared for.

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Lining Track

What period of the day is most suitable for lining track? Why **?**

Likes to Line after a Rain

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

Where the lining is done in conjunction with other work, I prefer to do it in the late afternoon. At this time the sunlight is not so dazzling, the rails have usually cooled down somewhat from their maximum and there is less danger of the track buckling. At other times I prefer to do the lining after a rain while the ballast is still wet, as the track is easier to shift at this time. There is also less danger of humping the track if the work is done with track liners while, if the ballast contains any fine material, it is less inclined to run under the ties as they are moved. A rain also usually cools the rails, which reduces the chance of buckling and the light is generally more favorable for doing a finished job.

Can Line Better in the Cooler Hours

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

It has been my experience that one can get a more nearly perfect line on the track when the lining is done early in the morning or late in the evening, especially during the summer when the mid-day temperature is high and the light is dazzling. The glare on the rail, which is so pronounced during the middle of the day and which often seriously affects one's eyesight, is considerably subdued or entirely absent during the cooler hours of the morning and evening. Obviously, these statements do not apply to cloudy weather for on cloudy days one time is about as favorable as another. On bright days, however, foremen who find it necessary to line under the unfavorable conditions of mid-day should, for their own protection, always stand with their backs to the sun. This will also enable them to do a smoother job of lining.

Should Have No Set Time for Lining

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

To begin with, I am opposed to having any set time for lining track. Under our present system of maintenance, any track that is disturbed for any purpose must be completed and put in condition for high speed as quickly as possible. This means that the lining shall be done whenever the track is ready, irrespective of the time of day. Again, where track that has not been disturbed is found to need lining, it should be cared for at once, without waiting for a more convenient time or for more favorable conditions.

On the other hand, if it is a case of improving the general line where waiting for favorable conditions will

in no way interfere with traffic, I choose the early morning to do the work, such work ordinarily being done during the summer months. At this time the men are fresh and they will do the work with more vim and in less time. At this time of day the light is less glaring and does not put the severe strain on the eyes that always occurs during the middle of the day. Furthermore, during the night the rail has had an opportunity to cool down and gain some expansion, thus making it easier to shift the track. When the rails are expanded until they are tight, an excessive effort is required to do the lining and there is always danger that the track may buckle.

If the weather is cloudy, the light for lining may be superior to that in either the morning or evening of a clear day. In this event, the lining can be done with equal facility at any hour, provided the temperature of the rail is such that it has not expanded until it is tight.

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Painting Structural Steel

What special precautions are required when painting structural steel in hot weather ?

Should Not Be Painted When Hot

By Master Painter

Painting, like every other art, is based on certain fundamental principles which cannot be violated with impunity. While to the average layman the painting of a steel surface might seem to be a simple operation, to the skilled painter it is not so simple and the spreading of the paint is only one item of many that must be given careful consideration.

Among these many items, the selection of a paint of proper quality and durability holds the place of first importance. Of no less importance, however, the surface to be painted must be clean and free from scale and rust. These matters having been properly provided for, the manner of making the application and the conditions under which it is made become of prime importance. Temperature and moisture have a decided influence on the quality of the protection provided and the service life of the paint. If the paint is applied to a cold, wet surface, it will not adhere and will eventually peel. If the surface is dry but cold, the paint does not harden readily, but, unless an excessive amount of dryer is used, may remain soft and sticky. Too much drier makes the film hard and brittle, with a tendency to chip.

In contrast to these results, while application of the paint to a cold surface retards the process of drying or hardening, when the paint is applied to a hot surface the drying is accelerated and the paint film becomes hard and brittle. Linseed oil is the vehicle commonly used in good bridge paints. The drying of the paint is in reality a hardening of the oil as it takes up oxygen from the air. If the oxidation proceeds in the normal manner, the paint film will be tough and elastic; if it is retarded too much, the paint will remain soft and sticky; while rapid oxidation makes it brittle.

Structural steel exposed to direct sunlight absorbs heat. When the atmospheric temperature is high, the radiation of this heat may be much slower than the rate of absorption, so that the temperature of the steel will rise many degrees above that of the surrounding air.

If an attempt is made to apply paint when the steel has reached a high temperature, as it does during hot days, two things happen. First, as has been stated, the drying process is so accelerated as to damage the paint film, shorten its life and make the protection it affords an uncertain quantity. Second, particularly in the South, the heat is often so intense as to burn the workmen and not a few cases of sunstroke have occurred among bridge painters. Others have been overcome with the heat so that they have been unable to continue at work.

There are no precautions that can be observed under these conditions. In hot climates, it is better to arrange the painting schedule so that the painting can be done in the cooler seasons of spring or fall. Farther north, the period when structural steel cannot be painted to advantage is comparatively short and the schedules can generally be arranged to avoid the necessity of painting under adverse conditions.

Will Cause Paint to Chalk

By E. C. NEVILLE
Bridge and Building Master, Canadian National, Toronto, Ont.

Since paint is applied to bridges primarily to protect them from deterioration, and thus becomes in a very real sense a form of insurance, it is only reasonable to expect that those responsible for their maintenance shall give serious thought to securing the safest insurance by obtaining the best practicable job of painting. For this reason and because the dangers of painting steel in very hot weather are often ignored, I consider this question a very timely and important one.

Applying paint to heated surfaces is one of the common causes of chalking, a term which is used to designate that form of paint failure which occurs as a disintegration of the paint film in such a way that the particles of pigment become separated so that they appear as a powder on the surface and can as easily be brushed off. This form of failure occurs as a result of the destruction of the oil which acts as a vehicle for the pigment and as a binder to hold it together.

When the paint film is applied in the ordinary manner with a brush, the film is only about 0.004 in. in thickness. It "dries" by hardening as a result of the chemical combination of oxygen from the air with the vehicle. It is only natural, therefore, in applying the film of paint to a heated surface that the natural processes are disturbed and the proper results are not obtained. Unfortunately, this matter has often failed to receive the attention it deserves, with the result that many structures are not receiving the protection to which they are entitled and which they are supposed to have been given. To avoid this situation, bridge painting should be so planned that those parts of the structure that are not affected by the rays of the sun until late in the afternoon shall be painted during the early hours of the day, thus giving the paint an opportunity to get some of its set before the steel surface becomes heated.

Structures that are wholly exposed throughout the day, particularly surfaces of large area, as plate girders, can be given a simple and adequate protection by means of light tarpaulins, or painters sheets, arranged to form a canopy. I have found that this simple expedient serves two purposes. It protects the painters as well as the painted surface. To erect them properly costs so little that the added expense on the job is negligible, while the ultimate saving is many times the cost, and is probably the cheapest insurance that can be obtained.

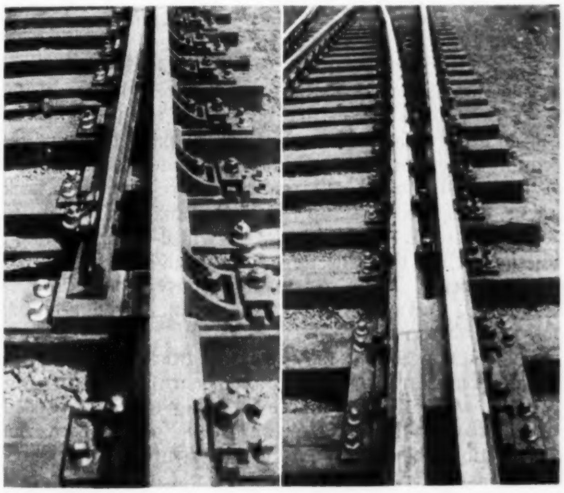
FREIGHT TRAFFIC.—Freight traffic handled by the Class I railroads in May amounted to 21,731,663,000 net ton-miles, an increase of 1,859,801 net ton-miles, or 9.4 per cent, above that of the same month in 1932, although it was still 27.6 per cent under May, 1931, according to reports compiled by the Bureau of Railway Economics.

New Device

Develop Turnout of GEO Construction

PROGRESS in the application of GEO track construction in this country has been advanced by another significant step through the design of a complete turnout in accordance with American track standards, and a complete installation of a No. 10 turnout has been placed on exhibit at A Century of Progress Exposition, together with 500 ft. of GEO track. This installation, which is being exhibited jointly by The Lorain Steel Company, the Carnegie Steel Company and the Illinois Steel Company, is located immediately south of the Travel and Transport building in the area set aside for the parking of some of the world's famous trains.

The GEO track installations in this country, which now embrace a total of 31 miles of track, in addition to 5 miles for which material has been delivered but not installed, comprise an adaptation of a German development that has been applied to 12,917 miles of track in that country. So, also, the American GEO turnout was adapted from designs developed in Germany and applied



A View at the Switch Point and from the Heel of the Switch Toward the Frog

to 50,600 turnouts in German railways. Briefly, the GEO turnout comprises an application, under the special requirements imposed in switch, frog and guardrail design, of the rail fastenings, tie plates and joint bars that go to make up GEO construction as applied to standard track.

As described in detail in *Railway Engineering and Maintenance* for January, 1930, page 16, GEO construction embodies a combination of a special form of tie plate, with independent fastenings of the tie plate to the tie and of the rail to the tie plate, that effects a rigidity of assembly not obtained in ordinary track construction. The plate is fastened rigidly to the tie by means of four screw spikes. It is wide and of heavy rolled steel with high ribs on each side of the rail base, each rib being milled to suit the semi-elliptical head of the clamp bolt. The rail is secured to the plate by means of two "U"-shaped clamps which straddle the ribs, one on each side of the rail and opposite each other. The short leg of the clamp bears on the rail base and the long leg on the tie plate outside the rib. Clamp bolts, which are inserted in the rib slots, are equipped with double coil spring washers and hold the clamps down on the rail base and tie plate. Compressed and creosoted wooden shims are inserted between the rail base and the tie plate and these protrude beyond the edges of the plates so that exposure to the elements causes the projecting portions to swell, thereby preventing the shims from working out of place endwise under traffic.

Among the advantages ascribed to this construction are the virtual elimination of rail creeping, reduced wear of ties and rail, a marked increase in the stiffness of the track which insures better line and surface at a considerably reduced maintenance cost, a reduction in shock by the use of wooden shims, and an increase of safety. Moreover, since GEO track is laid with less than the normal expansion allowance, there is a resulting decrease in end batter.

The No. 10 left-hand turnout installed at Chicago was made to conform to Illinois Central standards so far as practicable. Both the switch points and the frog are 15 ft. long and the latter is of the rail-bound manganese type. The guard rails are 11 ft. long and are of the kinked-rail type with heel chocks and guard-rail clamps.

The switch presents several radical departures from the conventional type. The points are made of a special section. The web is about three times as thick as the normal tee-rail web, and because of this extra thickness it was possible to eliminate the reinforcing bars and the holes for them. The heel end of the switch point is made to conform to the standard tee-rail section with which it is used to obviate the necessity for a compromise joint. To add further strength and wear-resisting qualities, the switch point was heat treated.

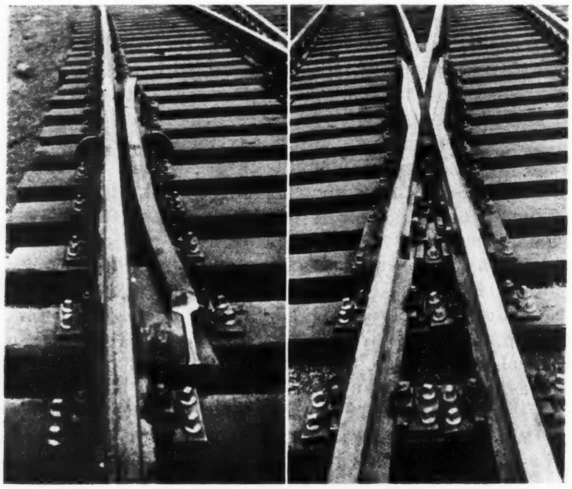
The point was planed to an inverted "V" shape, to secure the extra strength from the full thickness of the web and to eliminate the chipping and spalling often encountered at the tip of switch points. The stock rail was planed to obtain a snug fit against the switch point, but in such a way that half of the thickness of the point and projects outside the gage lone of the stock rail. Switch rod clips of heavy annealed cast steel are fitted accurately against the web and the top of the base of the switch rail, as well as the bottom of the switch point base.

The riser plates are considerably higher than usual—so high, in fact, that they are undercut to receive the inside flange of the stock rail, providing a positive hold-down for the inside of the stock rail and a full bearing for the base of the point rails. The switch shown in the illustration was made with tapered risers, with risers on the gage plate and first four slide plates 1¼ in. above the base of the stock rail, and the last four risers tapering down by ⅛ in. per plate to ¾ in. for the last plate, although these plates could have been made with uniform 1¼-in. risers through the switch point.

The brace end of the riser plates differs radically from the usual type of rail brace, which ordinarily serves the double purpose of holding down the outside flange of the stock rail and holding the stock rail to line. In the GEO design of brace assembly, the stock rail hold-down and the rail brace are independent of each other, each being affected by a separate plate rib, clamp and bolt assemblies. One of these, located inside of the rail brace, holds down the stock rail base, while the other performs the same function for the rail brace. The brace is made adjustable by a special vertical wedge which bears against the taper on the back of the brace on one side and against a similar taper on a rib of the riser plate. On account of the undercut in the riser plates that serves to hold down the in-

side edges of the stock rail base, it is necessary to move the stock rail out ⅝ in. to release it. Consequently provision was made for this in designing the hold-down for the stock rail by providing a lug ⅝ in. wide on these clamps. This is also taken into account in the construction of the gage plate and the assembly at the heel of the switch point.

At the heel of the switch the construction is similar to that provided at rail joints in standard GEO construction with the exceptions that the heel plates support the two rails and that provision has been made for the necessary ⅝-in. lateral movement required for the release of the stock rail. The heel block is of cast steel and is planed



The Guard Rail and the Frog

in such a way as to make the pivot point for throwing the point rail come at the bolt nearest the point of the switch. In this way, less movement of the switch point on the heel plate is obtained, which means that the rib may be set closer to the point rail.

Between the heel of the switch and the frog there are a number of plates which accommodate both the straight and turnout rails. These are of two types. One type has a standard rib on each end and a middle rib that supports a single clamp which bears on the bases of both rails. Beyond the three-ribbed plates, the spread of the rails becomes such that it is possible on several ties to use a double plate with standard ribs, while beyond these there are two standard plates with the corners clipped off for clearance and from thence on to a point near the frog, standard length plates are used. A somewhat similar arrangement of special plates is employed where the rails converge approaching the frog.

The plates under the frog, with the exception of the toe and heel plates, are for use on single ties and have a rib at each end, placed at proper angles to suit the contour of the edges of the running and wing-rail bases. Wooden shims are placed under the frog on all plates. The frog heel plate is similar to the toe plate except that is has a low rib in the middle to prevent lateral movement of the rails.

Beyond the frog heel plate, there is one double plate with standard ribs, which employs the standard clamps, and on the next tie are two standard plates with the corners clipped off for clearance. Beyond these, the standard plates are used for several ties and then there is a change to the 1:40 canted plate used in regular track construction.

The guard rails are of the kinked type, employing cast steel flare chocks, held in position with one bolt each. A Lorain standard guard-rail clamp was placed opposite the frog point on each guard rail. The guard rail plates are of the two-ribbed type, utilizing the standard rolled clamps. The ribs are parallel to the running rail base and to the guard rail base, the interval between the ribs being filled with wooden shims.

While the tie plates used in the exhibition turnout are all flat, new designs have been worked out to cover the use of 1:40 canted plates throughout the turnout. The stock rails are to be canted but the point rails will be level along the riser plates until the heel plate is reached, where the cant will be effected by either twisting or planing the rail. The frog is level through the body, with the arms twisted to the 1:40 cant. At the guard rails, the running rail is canted while the guard rail is set level.

In the opinion of the engineers who developed the details of this turnout, the GEO fastenings will also prove effective in railroad crossings, in that they will eliminate the creeping and slewing of ties, and obviate the looseness and poor alinement which so often develops.

Letters to the Editor

Reclaiming Kinked Rails

Wellington, Kan.

To the Editor:

I have read with much interest the discussion on kinked rails which appeared in the March issue. I agree fully as to the various causes that contribute to the conditions and, in general, as to the safeguards looking to their prevention as set forth; but I do not concede that all classes of bent and kinked rails should be relegated to back tracks, or classed as scrap rails. Rail manufacturers are not responsible for accidents or wheel-damaged rails; whether or not the rails have been straightened does not concern them. Their responsibility covers only production defects and specification requirements throughout the period of the guarantee.

The releasing of the rails from the track, together with the purchase, transportation and distribution of relief rails, as well as the ultimate handling of the scrapped rails, involves heavy expenditure. For this reason, such action should be considered carefully and minimized as much as is consistent with safety and smooth riding, keeping in mind economy of labor and material. There are extreme cases where kinked rails should be relegated to unimportant tracks or classified as scrap. Yet, most rails receiving this kind of damage can be reconditioned at small expense and safely allowed to remain in service. Rails kinked by engine counterbalance effects are usually disposed of by wholesale removal, although, in most cases, all but a few can be reconditioned without being removed from the track if the proper method is applied.

During the past decade, and while in active service as general track inspector on the Western lines of the Atchison, Topeka & Santa Fe, I personally supervised, and also gave instructions with respect to the reconditioning of many counterbalance-kinked rails of both 90 and 110-lb. sections, without removing the rails from the track, and without a single case of rail failure in all these years. I want to emphasize that this was in main-line track over which heavy power was operated and which carried a large tonnage moving in both high and low-speed trains, as severe a test as any to which rails can be subjected. At

one time representative kinked rails were furnished to the test department—some that had been straightened and others that had not. These rails were carefully tested, with the result that the method of reconditioning was determined to be both practical and safe. It was definitely understood, however, that defective and wheel-burned rails should not be reconditioned for main-track service. This test, coupled with our years of experience and success in following this practice validates the method.

Engine-counterbalance damage usually consists of short, sharp, downward vertical kinks, with lateral, inward line kinks in the gage of the ball of the rail, both the vertical and the lateral kinks being produced simultaneously by the same impact. From one to three kinks may occur in a 39-ft. rail and they may be of varying magnitude, ranging from very heavy to very light. This damage is often omitted for a few rail lengths and then continues, often with seemingly renewed severity.

When the kink is first produced, the depression on the top surface of the ball can be measured for a distance of three to six inches in either direction from the center. The blow also usually depresses and loosens one or two ties directly beneath the point of impact. If they are not given attention, the track at this point deteriorates rapidly, and the initial depression develops to greater depth and length under continued impacts from the wheels, progressing to a more serious condition.

Counterbalance-kinked rails should have prompt attention as soon as the damage is discovered. The method employed to redeem such rails, involves the proper use of the Sampson, or other type of rail bender which can be applied in the same manner, and adequate use of tamping picks. The first action should be to work through the stretch of damaged rail quickly, springing it up slightly and tamping solidly the loose ties directly underneath the kinks. If a kink is not directly over a tie, the end of the nearest tie should be moved to a position directly under the kink and tamped solidly. In some cases, this will necessitate tamping one or both adjoining ties. By this means, the kinked rails will be supported temporarily until they can be reached in turn and worked with the rail bender.

The downward and inward kinks are produced simultaneously with one thrust, and in order to remove a kink a sufficient bending action should be applied in the reverse direction, i.e., upward and outward, simultaneously. To do this, draw the spikes from the end of the tie directly beneath the kink, and if the tie is plated, leave the plate in place. With the track jack placed near the kink, raise the track just high enough to place a track spike at right angles directly under the kink. Remove the jack and the full weight of the track will then rest on the spike, producing an upward force at the kink. Next, place the rail bender in a canted position so that it will produce bending action upwardly and outwardly simultaneously in one effort, using care to insure that the application is made at the exact center of the downward kink, giving preference to the upward effect, as the downward kink is the most difficult to remove. Bend the rail slowly until the kink appears to be reversed well beyond the required limit. Then let it set a few moments before releasing, as the kink will spring back some when released. If it is found upon release that the reversal is not sufficient, the operation should be repeated. If the rail is given too much lateral reverse bend, this can easily be corrected. Remove the bender and the spike and tamp up the one tie solidly; also tamp the adjacent tie on either side very lightly. It may require repeated tampings to get all ties seated properly, but when this has been done, the ties can be moved back to their original positions, where they should be tamped permanently.

It is necessary to use a short block under the bender frame, placing it back of the wrench to hold the frame in a canted position while wrenching. Where available, it is best to use a bender for the next larger rail section than that being worked, since this will provide more shifting room for the canted adjustment and will insure a bender of greater strength. If working in cool or cloudy weather, it will be necessary to warm the rail at the kink just enough to take out the chill. This should be done ahead of the bender work and can be accomplished by small hand torches, such as are used by the mechanical department, placing one on either side of the rail at the kink so that the flame will contact the ball of the rail. Where the reconditioning is extensive and a good-sized force of laborers is available, an acetylene heating torch can be used to warm the kinks ahead of the railbender, thus facilitating the operation, but this should be done with judgment.

Three classes of rails should not be straightened or continued in main-track service; rails with rolling defects, wheel-burned or nicked rails, and counterbalance-kinked rails with an exaggerated vertical kink that extends downwardly, involving the rail base. None of these can be reconditioned satisfactorily. Such a condition sometimes occurs over non-supporting ties or soft spots in the roadbed. All other kinks, in the ball of the rail, even where visible skin disturbances extend part way between the ball and the rail base, can be satisfactorily and safely corrected and the rails can be continued in service without it being necessary to release them.

W. H. Cleveland,
Retired General Track Inspector,
Atchison, Topeka & Santa Fe

Painting to Retard Decay

Madison, Wis.

To the Editor:

I have read with interest the discussions by Messrs. Belden and Becker on the retarding of decay below floors, which appear on pages 336-337 of *Railway Engineering and Maintenance* for July. Both of these authors state the case quite well, and there is little more that can be said concisely than they have already said.

There is one suggestion in Mr. Belden's article, however, to which I wish to take exception. Apparently, he is under the impression that the waterproofing value of paints, especially of aluminum paints, is sufficient to give significant protection against decay. I do not believe this to be true. We know from many studies that although aluminum and other paints retard the absorption of moisture to a considerable degree, they do not prevent it. Any timber, therefore, that is continuously exposed for a long period to dampness, even though it only be in air of high humidity, will take up moisture and ultimately can become wet enough to decay. Although some slight degree of protection against decay may result occasionally from the intelligent use of paints as moisture-proofers, I think it best never to recommend their use.

In the great majority of cases, I believe that their use will be valueless and in some cases, the presence of paint may even hasten decay if the water gets into the wood through a crack or otherwise and the paint is present to retard its evaporation. For this reason, as an amendment to Mr. Belden's article, I would recommend the elimination of the last paragraph (No. 6 of the numbered paragraphs) and of the seventh paragraph preceding it which referred to painting.

George M. Hunt.
In charge, Section of Wood Preservation,
Forest Products Laboratory

News of the Month . . .

I. C. C. Dismisses All Recapture Proceedings

The Interstate Commerce Commission, having under consideration the sections of the Emergency Railroad Transportation Act of 1933 repealing the recapture provisions of the Interstate Commerce Act, has issued an order vacating all final orders previously issued by the commission for the recovery of excess net railway operating income. All other proceedings pending before the commission for the recovery of excess income, including those in which tentative reports have been issued, have also been dismissed.

Rail Employment Larger in June

The number of employees on the Class I railroads of the United States as of the middle of June totaled 957,330, an increase of 20,227 as compared with the middle of May, but a decrease of 90,153, or 7.15 per cent, as compared with June, 1932, according to a report issued by the Interstate Commerce Commission. The percentage decrease from last year, however, compares with decreases of 12 to 14 per cent for previous months. The principal increase in June took place among train and engine service employees which totaled 194,431, or 1.37 per cent greater than the number in June, 1932. The number of maintenance of way and structures employees was 11.57 per cent less in June, 1933, than in the same month of last year.

Reduced Fares on L. & N. Bring Passenger Traffic

Since April 1, 1933, when the Louisville & Nashville placed in effect passenger fares of two cents a mile in coaches and three cents in Pullman cars, the passenger business of this road has shown an appreciable increase. In April 78.7 per cent more passengers were carried than in March, 1933, and 18.3 per cent more than in April, 1932. The passenger revenue in April increased $41,420, or 14.6 per cent, over March, 1933, although as compared with April, 1932, there was a decrease of $116,533, or 26.38 per cent. The indications are that May and June will exceed April in passenger revenues.

May Net Income of Railroads Ahead of 1932

For May the Class I railroads of the United States had a net railway operating income of $40,693,072, which was at the annual rate of 2.04 per cent on their property investment, as compared with a net of $11,665,702, or 0.58 per cent, in May, 1932, according to the reports compiled by the Bureau of Railway Economics. Operating revenues of these railroads for May totaled $255,255,756, as compared with $251,921,717 in the same month of 1932, an increase of 1.3 per cent. For the first five months of 1933 these railroads had a net of $93,431,647, or 1.06 per cent, as compared with $97,313,173, or 1.10 per cent, in the same period of 1932. Operating revenues for the first five months totaled $1,136,926,253, compared with $1,339,825,485 in 1932, a decrease of 15.1 per cent.

Railroads Oppose Missouri River Project

A protest against the proposed project for a nine-foot channel in the Missouri river from its mouth to Sioux City, Iowa, was filed with the United States War department on July 10 by the Chicago & North Western; the Chicago, Burlington & Quincy; the Chicago, Milwaukee, St. Paul & Pacific and the Northern Pacific. This protest, which is printed in a pamphlet of 41 pages, discusses the project from all angles, including the excessive cost, the futility of reservoirs as a means of equalizing the flow, the extravagant claims for benefits to adjoining lands and the unwarranted estimates of the potential traffic and points to the surplus of transportation facilities that would result from the completion of the alleged improvement.

Eastman Announces Appointments to His Staff

Joseph B. Eastman, federal co-ordinator of transportation, on July 10 announced his initial organization, including appointments to three sections to be located at Washington dealing with freight service, car pooling and purchases, regional directors and traffic assistants for the eastern, western and southern regions, and an executive and research staff at Washington. Appointments to the three sections are as follows: Director, Section of Freight Service, J. R. Turney, vice-president, law and traffic, St. Louis Southwestern; director, Section of Car Pooling, O. C. Castle, superintendent of transportation, Southern Pacific Lines in Texas and Louisiana; and director, Section of Purchases, R. L. Lockwood, Washington, D. C. The regional director and traffic assistants are as follows: Eastern regional director, H. J. German, president, Montour railroad, Pittsburgh, Pa.; western regional director, V. V. Boatner, formerly president, Chicago Great Western, Chicago; and southern regional director, C. E. Weaver, assistant general manager and chief engineer, Central of Georgia, Savannah, Ga. The traffic assistants are: Eastern, W. H. Chandler, New York City; western, C. E. Hochstedler, Chicago; and southern, M. M. Caskie, Mobile, Ala. Executives of railroads in the Eastern, Western and Southern group have also selected regional co-ordinating committees to represent the railroads in accordance with the Emergency Transportation Act of 1933.

Estimate 10 Per Cent Increase in Car Loadings

Freight car loadings in the third quarter of 1933 will be approximately 10 per cent above actual loadings in the same quarter of 1932, according to estimates compiled by the 13 shippers' regional advisory boards. This is the first time since the fourth quarter of 1929 that these estimates have indicated a rise in traffic over the same quarter of the previous year. Of the 13 regional boards, the territories of which cover the entire United States, 12 reported increases in the estimated car loadings and only one, the Trans-Missouri-Kansas, reported an anticipated decrease, due to a reduction in the grain crop in that territory. Of the 29 commodities covered in the forecast, it is anticipated that 23 will show increases. Some of the largest increases expected are 92.5 per cent for ore and concentrates; 49.1 per cent for automobiles, trucks and parts; 47.1 for iron and steel; and 45.5 per cent for cotton.

Highway Carrier Law Passed in West Virginia

With the enactment of legislation providing more stringent regulations applying to the operation of highway motor carriers in West Virginia, another state has been added to the list of those who have found it advisable to curtail the operation of such vehicles. In the West Virginia law regulatory control over motor vehicle operations is given to the state road commissioner and no vehicle will henceforth be permitted to operate as a carrier of passengers or property for hire unless the operator obtains a permit or certificate of convenience. The commissioner is empowered to prescribe routes, schedules, rates and other conditions. Annual fees for private trucks vary from $15 for a pneumatic-tired vehicle of one-ton capacity or less to $540 and $810, respectively, for pneumatic-tired and solid-tired 10-ton vehicles. Passenger carriers are assessed a yearly registration fee according to the capacity of the vehicle and in addition pay a fee of 1/13 cent per seat mile.

Railroads Move Reforestation Army of 400,000 Men

Because the movement of almost 400,000 men and officers enrolled in the Civilian Conservation Corps from their homes to concentration camps during April, May and June of this year involved an emergency comparable only to the situation during the war when 3,000,000 soldiers were transported, the railroads were called upon again to demonstrate their ability to handle mass movements. Following the act of Congress in April, whereby unemployed men between the ages of 18 and 25 years were hired by the government to engage in reforestation work, the United States Army called upon the railroads to transport the 310,000 persons enrolled and their

officers, equipment and food. Ten days after notification the railroad's organization was perfected and the movement of the reforestation army began. Besides furnishing transportation to the rail head at destination the railroads arranged for transportation from the rail head to the work camps, forests and national parks, and throughout the entire movement there was not a failure. By joint agreement, the railroads considered the movement quasi-charitable and established favorable rates, enabling them to secure revenues totaling $6,000,000.

Passenger Traffic Into Chicago on July 4 Was Heavy

One of the heaviest movements of passenger traffic in the Middle West in recent years was recorded during the week-end of June 30 to July 4, when the 22 railroads operating passenger service into Chicago transported approximately 80,000 passengers into the city on the five days. This movement was stimulated by the low rates offered by the railroads and by the Century of Progress Exposition. The largest portion of the traffic came from the East and was brought in by the Pennsylvania, the New York Central and the Baltimore & Ohio. The Pennsylvania and the New York Central each carried 7,000 passengers into Chicago on July 2. During the five days the Pennsylvania operated 60 extra sections, while its entire movement required 1,000 extra sleeping cars and coaches. Arrivals on the Illinois Central on July 1 to 4 totaled 8,419 passengers, the revenue from this special business amounting to $75,000.

Railroads Add Shop Workers as Business Increases

Owing to the fact that for nearly three months weekly railroad freight car loadings have been greater than the loadings for the same weeks of 1932, railroads throughout the country have found it necessary to make substantial increases in their locomotive and freight car repair programs, resulting in the employment of many additional shopmen and in increasing the working time of many others. Reports from 8 typical roads show that approximately 5,400 employees have been added to the locomotive and car repair shops of these roads during the last three months. Instances of some of the more substantial increases in employment are given below. On June 26, 330 men returned to work in the Mount Clare locomotive repair shops of the Baltimore & Ohio and 200 car men were called back to work for light repairs on freight equipment at various points on the system. Since May 1, the forces in the locomotive and car departments of the Elgin, Joliet & Eastern have been increased approximately 450. On July 10 the Great Northern added a total of 848 men to the forces in its shops at various points on the system, while the working forces in the locomotive and car departments of the Illinois Central have been increased by approximately 415 men. The Louisville & Nashville has authorized increases in its shop employees totaling 493 men, and since April the Missouri-Kansas-Texas has put 800 men to work in its shops.

Association News

Bridge and Building Association

Approximately 60 members have already indicated their intention of attending a get-together dinner at Chicago on the evening of August 29, incident to a visit to the Century of Progress Exposition. The Executive committee will meet during the day to transact the business of the association.

Roadmasters' Association

At a meeting of the Executive committee in Chicago on July 22, it was decided that conditions on the railways had not yet improved sufficiently to warrant the holding of a convention and it was decided, therefore, that the convention should be postponed until 1934. It was voted again to remit the dues for 1934 of all members in good standing, as was done in 1932 and 1933. It was voted also to issue at least two bulletins to the members during the remainder of the year.

Arrangements were made for the publication in the October issue of *Railway Engineering and Maintenance* of the reports prepared originally for presentation at the 1931 convention, in order that the information may be made available to the members and to the railways without further delay. New committees will be appointed at a later meeting of the Executive committee to undertake the investigation of newer and more timely subjects.

American Railway Engineering Association

Honorary memberships for outstanding service to the association were recently conferred on two well-known members, George W. Kittredge, formerly chief engineer of the New York Central and a past president, and Dr. Arthur N. Talbot, professor emeritus of the College of Engineering, University of Illinois, and chairman of the association's Committee on Stresses in Track since it was organized in 1915.

July 29 was set as the last date for the acceptance of ballots on the proposition to adopt the proposed 112-lb. rail section as an association standard, and after the vote has been canvassed, the results will be forwarded to President W. P. Wiltsee for transmittal to the American Railway Association.

The Committee on Yards and Terminals met at Cincinnati on July 10, while the Special Committee on Stresses in Track and the Committee on Records and Accounts met at Chicago on July 11 and July 25, respectively. The Committee on Iron and Steel Structures met at Pittsburgh on July 20 and 21. The Committee on Rivers and Harbors was represented through participation on the part of its members in the meeting of the Special Committee on Engineering Research, Inland Waterways and Intercoastal Canals, of the A. R. A., which was held at Chicago on July 13, with an attendance of 45 representatives of railway engineering and legal departments.

Personal Mention

General

E. E. Adams, vice-president of the Union Pacific System, with headquarters at Omaha, Neb., and formerly consulting engineer for this system, has resigned to become vice-president of Pullman, Inc., in charge of a newly-established research department specially concerned with the development of transportation equipment.

H. M. Waite, who was chief engineer in charge of the construction of the Cincinnati (Ohio) Union Terminal, has been appointed by President Roosevelt as assistant administrator in charge of the public works program to be undertaken under the terms of the National Industrial Recovery Act, which appropriates $3,300,000 for the construction of public works of all kinds.

C. W. Van Nort, division engineer of the Pittsburgh division of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been promoted to superintendent of the Erie & Ashtabula division, with headquarters at New Castle, Pa. **C. G. Grove,** division engineer of the Pan Handle division, with headquarters at Pittsburgh, has been promoted to superintendent of the Wilkes-Barre division.

Engineering

G. J. Adamson, division engineer of the Kansas City division of the Union Pacific at Kansas City, Mo., and formerly chief engineer of this railroad, has been reappointed chief engineer, with headquarters at Omaha, Neb., to succeed **Lem Adams,** who has resigned to accept an executive position with the Oxweld Railroad Service Company, as noted elsewhere in these columns under Supply Trade News. **L. J. Hammond,** roadmaster at Salina, Kan., has been appointed division engineer at Kansas City to succeed Mr. Adams.

R. R. Metheany, engineer maintenance of way of the Southern division of the Pennsylvania, with headquarters at Wilmington, Del., has been transferred to Williamsport, Pa., to succeed **R. P. Graham,** who in turn has been transferred to the Southern division to succeed Mr. Metheany. **J. S. Gillum,** division engineer of the Erie & Ashtabula division, with headquarters at New Castle, Pa., has been transferred to the Ft. Wayne division, at Ft. Wayne, Ind., to succeed **W. W. Patchell,** who has been transferred to the Philadelphia (Pa.) terminal division. Mr. Patchell replaces **C. W. Van Nort,** whose promotion to superintendent is noted elsewhere in these columns. **R. H. Crew,** assistant division engineer of the Cincinnati division, with headquarters at Richmond, Ind., has been promoted to division engineer of the Indianapolis division, with headquarters at Indianapolis, Ind., to succeed **J. M. Fox,** who has been transferred to the Baltimore division, with headquarters at Baltimore, Md.

Track

R. F. Holden has been appointed assistant supervisor of track on the Southern, at Birminghan, Ala.

E. V. Tooley, roadmaster on the Gulf, Colorado & Santa Fe, has had his headquarters moved from San Augustine, Tex., to Longview.

F. M. Corbett has been appointed acting supervisor of track on the Grand Trunk Western, with headquarters at Valparaiso, Ind., to succeed **John Nolan,** who has been granted a leave of absence because of illness.

A. R. Memmott has been appointed roadmaster on division "C" of the Cloverleaf district of the New York, Chicago & St. Louis, with headquarters at Charleston, Ill., to succeed **O. C. McIntosh,** whose death is noted elsewhere in these columns.

V. L. Kapple, formerly a roadmaster on the Chicago, Burlington & Quincy, has been appointed acting roadmaster, with headquarters at Ottumwa, Iowa, to succeed **C. E. Anderson,** who has been furloughed indefinitely because of ill health. **A. C. Anderson,** who has been temporarily relieving C. E. Anderson, has been appointed roadmaster at Burlington, Iowa, to succeed **J. T. Corcoran,** deceased.

H. P. Sullivan has been appointed supervisor of track on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Mattoon, Ill., to succeed **John Barth,** who has retired after 51 years of continuous service with this company. Mr. Barth, who is 70 years old, first entered the service of the Big Four on October 1, 1882, as a trackman, being promoted to extra gang foreman on October 24, 1886. Subsequently he was appointed a track foreman and on March 11, 1900, he was further promoted to supervisor of track, which position he held continuously until his retirement.

G. C. Barnett, roadmaster on the Melville division of the Canadian National, has been transferred to the Regina division, with headquarters at Moose Jaw, Sask., to succeed **P. Woods. F. C. Mackay,** roadmaster on the Calgary division, with headquarters at Calgary, Alta., has had his jurisdiction extended to include the territory of **W. A. Chandler,** roadmaster, with headquarters also at Calgary. **J. R. McLean,** roadmaster on the Saskatoon division, has had his headquarters moved from Saskatoon, Sask., to North Battleford.

W. R. Groshell, roadmaster on the Valley division of the Atchison, Topeka & Santa Fe, with headquarters at Richmond, Cal., whose retirement was noted in the July issue, was born in Saxony, Germany, in 1863. He first entered railway service in this country in September, 1882, as a trackman on the Chicago, Milwaukee, St. Paul & Pacific, and later went with the Chicago, Rock Island & Pacific in the same capacity. He went with the Santa Fe in July, 1891, as a trackman and in October of the same year was promoted to track foreman. In October, 1905, Mr. Groshell was promoted to general foreman of extra gangs and in May, 1911, he was appointed roadmaster at Oceanside, Cal. Later he was transferred to the Albuquerque division and thence to the Valley division in March, 1915, where he served continuously until the time of his retirement.

Bridge and Building

W. H. Lytle, bridge and building supervisor on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Carey, Ohio, has been transferred to Anderson, Ind., and the territory formerly under Mr. Lytle has been placed under the jurisdiction of **C. E. Nichols,** supervisor of bridges and buildings at Bellefontaine, Ohio. **William Wallace,** supervisor of bridges and buildings at Van wert, Ohio, has retired.

Obituary

O. C. McIntosh, roadmaster on division "C" of the Cloverleaf district of the New York, Chicago & St. Louis, with headquarters at Charleston, Ill., died on July 4.

Michael J. Murphy, retired supervisor of track on the Lehigh Valley, died at his home in Wilkes-Barre, Pa., on June 10. Mr. Murphy, who was retired on January 1, 1932, was born on November 1, 1876, at White Haven, Pa., and began his railroad career with the Lehigh Valley as a track laborer in June, 1890, following education in the public schools of White Haven. In August, 1896, Mr. Murphy was promoted to section foreman at White Haven, and after serving in this capacity at various points until October, 1903, he was promoted to supervisor of track. He continued as supervisor until the time of his retirement, at which time he was located at Wilkes-Barre.

R. B. Abbott, assistant general superintendent on the Reading, with headquarters at Reading, Pa., and formerly a division engineer with this company, who died on June 25 as noted in the July issue, was born at Philadelphia, Pa., on July 14, 1881. He entered railway service with the Philadelphia & Reading on October 1, 1900, and in December of the same year was appointed assistant supervisor at Tamaqua, Pa. Early in 1905 he was transferred to Reading and two months later to Harrisburg, Pa. On June 6, 1905, he was promoted to supervisor at Allentown, Pa., later serving in the same capacity at Olney, Pa., Philadelphia and Pottsville. He was promoted to division engineer at Harrisburg in March, 1910, in which capacity he served until March, 1916, when he was promoted to superintendent of the Shamokin division, later in the same month being transferred to the Harrisburg division, with headquarters at Harrisburg. In August, 1918, Mr. Abbott was appointed superintendent of the New York division, and on March 1, 1920, was promoted to assistant general superintendent, which position he was holding at the time of his death.

Supply Trade News

Personal

Alexander D. Gillis, founder of **Gillis & Co.,** Chicago, died in that city on July 11.

Edward J. Bade, who has been employed in the laboratory of the **Dearborn Chemical Company,** Chicago, has been promoted to sales representative to succeed **A. C. Herrmann,** who has resigned to establish his own business.

A. F. Fifield, director of the Railway Appliances division of the **American Fork & Hoe Company,** Cleveland, Ohio, has been elected president to succeed **G. B. Durell,** who has been elected chairman of the board. **Stephen L. Henderson,** sales manager of the Railway Appliances division, has been appointed manager of that division, with headquarters as before at Cleveland. Mr. Fifield, who is 57 years old, was born in Lowell, Mass., and has had many years experience in various lines of manufacturing. Mr. Henderson was born in Toronto, Can., on June 28, 1889, and prior to entering the railway supply field he was connected with various railroads. These included the Canadian Pacific, the White Pass & Yukon, the Canadian Northern and the Canadian National. He has been sales manager of the Railway Appliances division of the American Fork & Hoe Company since 1927.

A. F. Fifield

At a meeting of the board of directors of the **Maloney Oil & Manufacturing Company,** Scranton, Pa., on June 23, the following officers were elected: **L. Carberry Ritchie,** president; **Walton R. Collins,** vice-president; and **James. M Collins,** treasurer. **M. M. Tinsley** was re-elected assistant to the president.

Concurrent with the announcement of the election of the new officers, the company announced a new line of emulsified asphalts for various industrial uses, which will bear the name "Collins," in honor of Maurice W. Collins, former president and treasurer of the company, and one of its founders. The new products include Industrial Mastic Flooring, Aquaseal, Roofcote, Fibur-Mastic, Weatherseal, Sealtite,

Tilecet and Masticet. These products will be handled in addition to the emulsified products of the Headley Emulsified Products Company, for which the Maloney Oil & Manufacturing Company has exclusive sales rights among the railways.

Walton R. Collins, the new vice-president, who will be in charge of sales, was born on October 29, 1897, at Scranton, Pa. After attending Bank's Business College, Philadelphia, Pa., he became associated with the Maloney Oil & Manufacturing Company first in 1918, when he was made manager of the company's Wilkes-Barre plant. In 1920 he left the company to enter the banking business at Scranton. In the fall of 1925, Mr. Collins returned to the Maloney Oil & Manufacturing Company as sales representative and assistant to his father, M. W. Collins. He continued in this capacity until his recent election as vice-president. Mr. Collins is also chairman of the Signal Appliance Association.

Walton R. Collins

Lem Adams, chief engineer of the Union Pacific railroad, with headquarters at Omaha, Neb., has resigned to become chief engineer of the **Oxweld Railroad Service Company,** with headquarters at Chicago, effective August 1. Mr. Adams, who has served in the engineering and maintenance of way departments of the Union Pacific System for more than 23 years, was born on June 6, 1886, at Buda, Tex. He was educated at the Texas A. & M. College, from which he graduated with the degree of bachelor of science in civil engineering. Mr. Adams entered railway service in June, 1909, as a rodman on the Oregon Short Line (part of the Union Pacific System), where he was appointed a draftsman a year later. In June, 1911, he was made an estimator and served in this position and as chief draftsman until March, 1916, when he was promoted to assistant division engineer. Mr. Adams was appointed an engineering accountant in the following year and in 1918 he became a contract engineer. After a year in this position he was transferred to the Union Pacific unit of the system with the title of special field engineer in the maintenance of way department, then being advanced to roadway assistant for the system at Omaha in April, 1920. On May 15, 1929, Mr. Adams was further promoted to general supervisor maintenance of way of the system at Omaha, which position he retained until September 16, 1931, when he was appointed engineer maintenance of way of the system. He has been chief engineer of the Union Pacific railroad since early this year.

Lem Adams

The International Railweld Corporation has been organized with headquarters at 1514 Straus building, Chicago, to engage in the building up of rail ends, the repair of frogs, crossings and switches, and the repair and strengthening of metal bridges by the electric welding process. The officers of the company are **I. B. Tanner,** president, **G. T. Willard,** vice-president, and **F. M. Condit,** secretary.

I. B. Tanner

Mr. Tanner, after serving for 12 years in various capacities in the engineering department of the Illinois Central, resigned on August 1, 1917, to become general superintendent with Joseph E. Nelson & Sons Company, Chicago, general contractors specializing in railway construction, with which company he was connected until its activities were suspended about a year ago. Subsequently he was retained as a special engineer by the Missouri Pacific Lines to investigate means for effecting economies in operation and maintenance on that property.

Mr. Willard was born in Topeka, Kan., in 1889, and was educated at Washburn College in that city. In 1908 he entered the employ of the Atchison, Topeka & Santa Fe and, after serving as a chairman, rodman and inspector, he joined the engineering staff of the Kansas City Terminal Railway in 1910 as a draftsman and later as office engineer and chief of field party. From 1912 to 1914 he served as assistant supervisor and assistant engineer on the Chicago & Western Indiana in the construction of the Clearing yard and on track elevation work. In 1914 he joined the sales staff of the Rail Joint Company, resigning in 1925 to become affiliated with the Railway Supply Company, Chicago, and its successor, the Track Supply Company, with which latter corporation he held the position of secretary at the time of his recent resignation.

G. T. Willard

Mr. Condit entered railway service in 1900 in the office of the division superintendent of the Illinois Central at Chicago. In 1903 he was transferred to the staff of the vice-president of the Yazoo & Mississippi Valley at Memphis, Tenn., and in 1906 he left railway service to enter the railway sales organization of Fairbanks, Morse & Co., Chicago. From that date until 1932, he held various positions, including those of manager of the railroad department, manager of the Chicago branch house and, most recently, district manager of the railroad division. For the past year he has been a member of the sales organization of the Track Supply Company.

F. M. Condit

ALPHABETICAL INDEX TO ADVERTISERS

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